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ABSTRACT

This report focuses on technology training programs for disabled persons, the contributions of access technology to the employment of disabled persons, the ability of traditional rehabilitation centers to train disabled persons for advanced technology occupations, and the placement and employment of disabled persons trained in new technologies. Following an introduction, the second chapter explores the impacts of new technology on the employment of disabled persons and describes the project, conducted by Rehabilitation International and sponsored by the International Labour Office, that resulted in this collection of papers. Subsequent chapters present the papers, as follows: "New Technology Training Programs for Disabled Persons in Great Britain" (Paul Cornes and others); "The Effect of New Technology on the Employment of Blind and Visually Impaired Persons in Four Western European Countries" (Lawrence A. Scadden); "Factors Associated with the Traditional Rehabilitation Centre's Ability To Train Disabled Persons for Advanced Technology Occupations" (Michael J. Leahy and Robert Leneway); "Computer-Based Technology for Disabled Persons in Working Life: A Holistic Approach" (Jan Breding and Ulf Keijer); "The Contributions of New Access Technology to the Employment of Disabled Persons in Japan" (Shinichi Okada and Takeshi Yatougo); "New Technologies and the Employment of Disabled Persons in Israel" (Emanuel) Chigier); "New Technologies and the Employment of Disabled Persons in Four Developed Countries" (Jacques Dawans); and "New Technology in Rehabilitation: A Hungarian Perspective" (Gyorgy Konczei). A final chapter draws conclusions and makes recommendations. (JDD)

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(c) to make the management of enterprises in different sectors more efficient, through training managers in modern management sciences in order to increase both productivity and management's awareness of its social responsibilities.

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# NEW TECHNOLOGIES AND THE EMPLOYMENT OF DISABLED PERSONS

# NEW TECHNOLOGIES AND THE EMPLOYMENT OF DISABLED PERSONS

Edited by
H. Allan Hunt
and
Monroe Berkowitz

International Labour Office Geneva

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# Preface

This is a report on the second phase of a project conducted by Rehabilitation International and sponsored by the International Labour Office. A brief summary of Phase 1 is included in Chapter 2. Phase 2 focuses on four new themes: (1) new technology training programmes for disabled persons; (2) the contributions of new access technology to the employment of disabled persons; (3) the ability of traditional rehabilitation centres to train disabled persons for advanced technology occupations; and (4) the placement and employment of disabled persons trained in new technologies.

We wanted to seek the views of persons in different countries on these issues, and a general request for proposals for research papers was made in October 1989. Contact was made with several dozen international agencies and other interested parties thought to have expertise in this area. An attempt was made to secure coverage of all four subject areas from differing national perspectives. Ultimately five of the proposed papers were selected and the individual scholars began work on their projects. In addition, three papers were offered by other individuals, whose views were judged valuable enough to justify their inclusion in the project.

Preliminary findings from each of the papers were presented at the European Regional Conference of Rehabilitation International in Dublin in May 1990, where the research team cross-validated their ideas with each other and with the audience at two programme sessions, one for the presentation of the formal papers, and one for informal interchange. After the Dublin meetings, the project co-directors provided individual feedback to the authors on their papers, and the final versions were submitted in autumn 1990. The papers presented below in Chapters 3 to 10 represent the final results of this process. The project co-directors were responsible for the first two chapters and the final chapter, which contains the conclusions and recommendations.

We wish to acknowledge our debt to many persons who helped at various stages of this project. Ed Sackstein of the ILO in Geneva guided us in the early stages of the project and provided helpful advice throughout. We took the opportunity to consult with Susan Hammerman, Secretary-General of Rehabilitation International, who was instrumental in arranging for ILO

sponsorship. We were also greatly helped by the staffs of Rehabilitation International, the W. E. Upjohn Institute for Employment Research and the Rutgers Bureau of Economic Research. We are particularly grateful for the assistance given us by Margaret Polansky and Elizabeth Anderson in the final editing chores.

Monroe Berkowitz

H. Allan Hunt

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# Part I. Introduction

# 1

## The task before us

*Monroe Berkowitz and H. Allan Hunt*

Our interest is in the relationship between what we shall call new technology or technologies (NT) and the employment of disabled persons. We live in the information age, and the rapid changes in the ways in which we communicate with each other are at the heart of NT. We seek to understand the implications of NT for the employment of disabled persons.

The miracle of NT is that they can make the blind see and the deaf hear, in a very real sense of what we mean by seeing and hearing. The examples are commonplace, but they often obscure the will and the determination of the individuals involved. The *New York Times* of 2 December 1990 carried the story of Lawrence Harvie, a 25-year-old university computer science student. Under the title "The wheelchair confines only the body inside", the story detailed the accomplishments of Mr. Harvie, who was born with cerebral palsy. Without aids, he cannot walk or speak and he has limited control over most of his body.

Mr. Harvie is able to push the lever which controls his electric wheelchair. He activates his computer keyboard with a small flashlight worn on the side of his head. The keyboard is connected to a computer-generated voice box mounted on the wheelchair. By shining the light on different keys, he is able to "speak". He types the words out, letter by letter, and the computer links them into syllables and speaks them. His mobile computer can be linked to the college's mainframe, through which he completes course assignments and writes papers. As the newspaper story makes clear, Harvie is an extraordinary person who is fortunate to be in an environment where he can make the most of his talents with the aid of NT.

Mr. Harvie is at the university level and has the preparatory education and the intelligence and determination to benefit from NT. Obviously, not all of us fit this mould. The question arises whether the computer revolution has employment effects on others not so generously endowed.

The answer is yes. The applications of NT may be used for the benefit of intellectually handicapped persons, as is illustrated in the modification of a workplace in Sweden. In one of the case studies cited by our contributors from Sweden, a rather complex workstation where the jobholder was required to package a certain number of pieces, with the number changing according to the product to be packaged, was modified with the aid of NT so that the job could be done by an intellectually handicapped person. Weighing machines and

computer-adapted visual displays were used so that the complex job could be done with only a few easily understood decisions to be made by the operator.

Example after example could be cited to show the marvellous potentialities of NT as applied to the employment of disabled persons. Obviously that is not enough. It is not sufficient merely to show that NT can be applied in particular cases: it is necessary to go further and explore some of the problems involved in bringing NT to disabled persons so that they can enter and make progress in the job market.

One of the lessons learned from the disability movement is that the employment of disabled persons depends on reducing the attitudinal barriers to employment. If one looks at blind persons and routinely thinks of training them only as broom-makers or masseuses, NT will be of little help. Our task in this project is not to analyse the national psyches of the countries involved and to prescribe remedies for outmoded attitudes; but we do recognise the importance of placing the problem of NT and the employment of disabled persons in context.

This is an international study which draws on contributors from seven nations and examines the experience in more than a dozen countries. The lessons learned are meant to be applicable to countries at different stages of development, although NT is necessarily most prominent in the more developed nations. At the same time we recognise the ubiquitous nature of NT and how it can be found everywhere.

Outside any of the new high-rise luxury hotels in Beijing, one can watch the farmers bringing their produce to market in hand-drawn carts. Some have the advantage of a bicycle cart, which is a significant technological advance, but there are few motor-driven conveyances. For the most part, when it comes to methods of transportation, it is traditional low technology that predominates.

Step inside the hotel and there one can take advantage of the "business centre" with the latest in computers, with the most recent software for data processing or spreadsheet programming. When one's work on the computer is finished, it is simplicity itself to send the result via the fax machine to any part of the globe.

Similar contrasts are found in the factories of China. A cosmetics factory employing a high percentage of persons with communication difficulties has an assembly line of workers packing jars and pasting labels by hand. But quality control data are processed by a computer, and the product testing is entrusted to the very latest laboratory equipment.

The old and the new exist side by side in all countries. But the inexorable trend is towards NT, because it offers the low-cost solution to the production problem as capital is substituted for labour. The use of NT allows us to accomplish new tasks, or to do the old in an entirely new way. Although one could say that the fax message looks just like a letter delivered through the post, the fact remains that it is different: a new phenomenon, with quite separate characteristics and entirely new demand and supply factors.

## The plan of the report

In Chapter 2 we explore some of the impacts of NT on employment, and particularly on the employment of disabled persons. We begin with a short summary of Phase 1 of the project, where some of these issues were examined. Although there is no doubt that NT provides access to jobs for disabled persons hitherto barred from the job market, we are conscious of the fact that NT destroys as well as creates jobs. As we shall see, the net effects are difficult to measure.

Part II, "New technology training programmes for disabled persons", has three chapters. Chapter 3 is the result of a survey of NT training programmes in Great Britain. The authors, Paul Cornes, Michael Floyd and Georg Boeckenfoerde, find quite a variety of programmes, sponsored largely by the voluntary sector. They find that these programmes have been quite effective in placing disabled persons in NT occupations. In addition, their survey points to the advantages of diversity in this rapidly changing area.

In Chapter 4 Lawrence Scadden reports on the results of his survey of programmes for blind and visually impaired persons in four European countries (Austria, Denmark, France and Germany). Although he finds much to commend in these training programmes, he also finds significant lags and omissions, as blind persons are still being trained for occupations which are fast fading in importance. Scadden's observations and recommendations are intended to remedy some of the problems.

In Chapter 5 two persons with experience in rehabilitation centres in the United States, Michael Leahy and Robert Leneway, analyse the problems encountered by two leading centres in adapting to NT. Particularly illuminating are the centres' relationships with the business people called in to advise them, and the effects of the collaboration on the centres' staffs.

Part III concentrates on new access technology and the employment of disabled persons. In Chapter 6 Jan Breding and Ulf Keijer report on Sweden's TUFFA project. This project is different in that it concentrates on prescribing the type of NT necessary to employ a particular person at a specific worksite. Right from the beginning, the TUFFA project recognised the necessity for a holistic approach which pays attention, not only to the hardware, but also to the human motivations and all the difficulties of a disabled person adapting to a new work situation.

Shinichi Okada and Takeshi Yatougo, in Chapter 7, examine the situation in Japan where grant funds are available from the levies under the quota system. These funds are used to adapt workplaces. There have been relatively few cases, and most of these have been confined to sensory impaired persons. But the number of cases is growing, and it is likely that Japan will be an important centre of innovation in the future.

In Chapter 8 Emanuel Chigier details some of the advances made in Israel. Labouring under the disadvantages of a small market for NT devices, various persons in Israel from the university and other sectors have displayed a

great deal of ingenuity in fashioning technical aids and other devices to further the employment chances of disabled persons.

Part IV has two chapters. In Chapter 9 Jacques Dawans examines IBM's activities in the area of NT and employment. Conscious of the fact that attention must be paid to the individual involved, the company has cooperated with rehabilitation agencies, educators and business groups in projects designed to put disabled persons to work. Dawans' work illustrates the results that can be accomplished with such cooperation.

Hungary is in the midst of rapid change and has not had a great deal of experience with NT. None the less, in Chapter 10, Györgi Konczei looks at the experiences of two groups of disabled persons who formed their own companies. One of these companies has been working in data processing and word processing, but the other has moved into more sophisticated programming. The future of the these efforts may well depend on the direction taken by the Hungarian economy in the future and possibly on reforms of its system of disability benefits. Yet it is instructive to view what has been accomplished against considerable odds.

The last chapter, Chapter 11, contains the editors' conclusions and recommendations. We are impressed by the activities that have been carried out in the voluntary and private sectors, yet believe there are several underdeveloped roles for governments in this area. We detail these possible roles and functions as regards research and information dissemination and the formulation of public policy which will encourage innovation and the employment of disabled persons. In this last chapter, we also review the common themes of the preceding chapters and stress the lessons we have learned.

We end the volume with some suggestions for future research. We are convinced that the nations of the world can learn from each other, although it is not always easy to present and explain to others what a particular national project has accomplished. We stress that these chapters describe significant examples of the use of NT to further the employment chances of disabled persons. We suspect that the next step is to go beyond description and cataloguing and to begin to evaluate what works and what does not. Sooner or later we must be concerned with the efficiency of these efforts and their respective costs and benefits.

# 2

# The background and setting

*H. Allan Hunt and Monroe Berkowitz*

> *Technological advance has probably been the major influence on the nature of the lives that we lead relative to the lives that our forebears had and our children and grandchildren will have.* (Stoneman, 1983, p. 1)

Technology has a vast impact on the way we live and do business. It helps to determine how we interact with one another, and with our environment. It influences our patterns of work and leisure: where and how we live, how we get back and forth from home to work, and what specific activities will fill our days at the workplace. Similarly, *changes* in technology are manifested in *changes* in these basic patterns of life. Technological change involves changes in the goods and services that are produced or changes in the way they are produced. It may involve improvements in efficiency (more output with the same input), improvements in the quality of the output, or the development of completely new products and services.

New technology (NT) encompasses the broad spectrum of products, tools and aids which incorporate the latest applications of science and engineering. For analytical purposes we subdivide NT into four areas:

(1) *product* technology, the technology incorporated in the final product of the organisation;

(2) *process* technology, the technology required to make the final product;

(3) *access* technology, the technology such as special aids and adaptations enabling the disabled person to do the job; and

(4) *indirect* technology, technology not found at the worksite but responsible in some way for facilitating the employment of the disabled person.

A worker might produce a "high-tech" product (new product technology such as a computer using hand assembly, use a high-tech device such as a laser cutter (new process technology) to produce traditional clothing products, locate a job through a computer-based job bank (new indirect technology) or be able to carry out a job physically only because of the assistance of some NT product such as a large-print-adapted microcomputer (new access technology).

This latter possibility – of applying NT (access technologies that provide *assistive or adaptive* services, especially those based on the microprocessor) to assist in overcoming the disabling effects of specific physical and mental conditions that have kept disabled workers at a disadvantage in the labour market – is very exciting news. If NT can raise the productivity of disabled workers to make them competitive with non-disabled workers, policy-makers need to know how to facilitate the adoption of these technologies, both to improve the economic lot of disabled workers and to improve the labour supply for society as a whole.

## Phase 1 of the ILO/RI project

The International Labour Office/Rehabilitation International project on "New technologies and the employment of disabled persons" began in 1986, when the ILO asked RI to undertake a cross-national study examining the extent to which the introduction of NT in industry and commerce had affected the employment of disabled persons, and identifying actual work situations where NT had resulted in wider job opportunities for the disabled.

Rehabilitation International, under the leadership of Susan Hammerman, implemented a research plan to answer these questions in six countries; Belgium, Japan, the Netherlands, Sweden, the United Kingdom and the United States. The study consisted of two major parts: an extensive international literature review, and a field study of specific applications of NT to employment situations of disabled persons.

Research collaborators in each of the six countries were charged with the responsibility of finding and reporting on such employment situations in their respective countries.[1] A common protocol with about 150 questions was developed to collect data on: (1) the general public policy environment of the country; (2) the organisational environment of the companies studied; and (3) the personal characteristics and worksite characteristics for successful placements of disabled persons in jobs using NT. The study design called for interviews with the individual workers involved, as well as their direct supervisors and division or personnel managers. A total of 33 individual disabled workers in jobs using NT were studied in the six countries.

The first phase of the research culminated with an experts' meeting on the impact of NT on the employment of persons with disabilities, held in Brussels in September 1987 under the aegis of Rehabilitation International and the Bureau in Favour of Action on Behalf of Persons with Disabilities in the Commission of the European Communities (CEC). The six country reports were presented at this meeting, together with reactions and extensions by delegates from Denmark, France, the Federal Republic of Germany, Ireland,

[1] Research collaborators were André Storm and Michael Dubois in Belgium, Tyosuke Matsui and Katsumi Nishikawa in Japan, Irene Nijboer in the Netherlands, Gunnar Ragfeldt in Sweden, Paul Cornes in the United Kingdom, and H. Allan Hunt in the United States.

Italy, Portugal, Spain, the CEC and the Organization for Economic Co-operation and Development (OECD).

## *Findings*

Phase 1 of the study concluded that "... the impact of new technology on net destruction or creation of jobs is fairly neutral... making meaningful prediction impossible. However, the impact of new technology on the nature of these jobs has been dramatic" (Moses, 1988, p. 8). These impacts are expressed in three main ways: the replacement of muscle power with cognitive skills, an increasing flexibility of time and place of work, and the use of new technical aids to overcome physical handicaps.

On the first point, Phase 1 concluded: "The shift from physical to cognitive requirements appears to be a plus for intelligent and emotionally (socially) mature people with physical impairments, but it implies that those with cognitive or developmental deficits may be excluded from the new workplace" (Moses, 1988, p. 8). In addition, it was noted that technological change in manufacturing was tending to eliminate the tedious and repetitive jobs which disabled persons had tended to occupy in the past.

Another observation from Phase 1 was that the new communications technologies permitted much more flexibility in the place and the time schedule of work. Several examples of remote or telework units were described in the study, and these were frequently a particular boon to disabled workers, who may have greater difficulty with transportation, or more trouble working a regular shift or schedule.

The technical aids made possible by NT were also prominently featured in Phase 1 of the ILO/RI study. Many of the workers interviewed depended on such aids to enable them to hold their jobs. However, grave concern was expressed over two policy issues: how the appropriate aids are to be located or developed for individual cases, and how such aids are to be paid for. The study urged that serious attention be given to policy development in these areas to ensure that the technology is applied in as many situations as possible.

Another important finding from Phase 1 bears repeating here. While the majority of job sites studied were unsubsidised competitive positions, it was noted that the attitude of the employing organisation seemed to be critical to these successes. However, it may not be sufficient to depend upon the corporate social conscience of a relatively small number of leading employers, particularly when the employment of disabled persons is regarded as a corporate responsibility rather than good business. One expression of this problem was the sensitivity of the outreach efforts to business conditions. In bad economic times, these placement efforts were virtually discontinued.

The study observed that: "All experts agree that a concerted, self-conscious effort to provide skills for the new workplace must be made by government and industry. Technical aids must be available through loan

arrangements and tax incentives to either individuals or employers. Special attention should be paid to efforts to preserve the open-endedness of process technology to adaptation for disabled people" (Moses, 1988, p. 9). It concluded that, if disabled people are to take advantage of the opportunities that technological change appears to offer, they must have access to the socialisation and training possibilities that are enjoyed by the non-disabled. Further, it was noted that this effort must be made now, at the beginning of the process, before disabled people fall so far behind in access to NT that they will never be able to catch up.

## Technology and the employment of disabled persons — Phase 2

We begin our discussion of Phase 2 of the project by concentrating on process technology, since that is the way that technology is most often perceived. Process technology describes the way that we make things, the "recipe" for producing various goods and services, using inputs of labour, capital, machines, energy and so on. An "improvement" in process technology enables a productive process (or the entire economy) to produce greater output from the same or fewer inputs.

We are inclined to think of changes in process technology as a threat to existing jobs (especially if it is our own job that is being automated). This is due to the fact that new process technologies are generally understood to involve the substitution of machines for human workers (or capital for labour), and hence seem in the first instance to be designed to reduce employment. Many times this is the primary impact, although the final, net impact is usually not so clear. It should be obvious that labour displacement by technology might be a social good, as in cases where potentially hazardous environments for humans can be avoided.[2] But in most cases the social good of greater efficiency and lower production costs must be weighed against the private cost of the displacement of workers that accompanies it.

Very often, new technology is introduced as a result of a change in the nature of the product (product technology), or because an entirely new process has been developed to produce the good or service more efficiently (process technology innovation). These changes frequently involve the substitution of new capital goods for both the capital and the labour previously employed. In other words, the innovation involves a reorganisation of production, and specifically of the jobs involved. The new investment is typically justified by anticipated cost reductions, by quality improvements, or perhaps by output increases without commensurate cost increases. Of course, in these competitive times, such innovations are also driven by developments in overseas markets; technological change is frequently defensive in motivation. However,

[2] Although it is still not always obvious that those who are being protected prefer their safe, but unemployed, status to their previous hazardous but well-paid existence.

the cause of the threat does not matter much to the workers who are displaced in the process.

Usually the desire to replace labour, to reduce employment, derives from the desire to reduce costs and to increase labour productivity, as a direct means to increase the profitability of the firm. In turn, through competition, this leads to lower prices and a greater scale of production, which makes up some of the employment losses.

An excellent recent review of the impacts of technology on employment by a high-level panel at the National Academy of Sciences in the United States found that: "Technological change is an essential component of a dynamic, expanding economy. Recent and prospective levels of technological change will not produce significant increases in total unemployment, although individuals will face painful and costly adjustments" (Cyert and Mowery, 1987, p. 3). This carefully considered overview of the employment impacts of technology is reassuring, and it properly focuses our attention on specific problems that are likely to be encountered along the way to the technological promised land. For our purposes here, how is technological change altering job opportunities for disabled persons? What jobs are being substantially modified or eliminated? What other jobs are being created? How will disabled people be affected?

## *Analysis of the general employment effects of NT*

Generally speaking, there is one most efficient "recipe" for producing a given product or service, given existing technology and the set of prices for the inputs needed for the productive process. The recipe specifies what inputs, or ingredients, are needed for the productive process, and in what quantities they must be combined. In a competitive market economy, firms will be pushed to use this method of production by their own desire to minimise costs or maximise profits. This abstraction of the production function is useful in thinking about process technology, even though we do not observe a world that fits it perfectly.

There are many situations in the real world where firms do not adopt the "state-of-the-art" technology, of course. First, "state-of-the-art" technology may not be the cheapest method of production. This is particularly clear where new, unproven technologies are involved. It may take several years to eliminate all the "bugs" from new production techniques. Even in a competitive environment, this provides time for all producers to assess NT and make their decisions about its implementation over a period of some years.

Second, there may be something unique to the environment of a particular firm that makes the cost-minimising production technique different in their case. One might include different price structures across nations as an example here. If the relative prices of capital, labour and other inputs differ between countries, there is no reason to expect that the most efficient means of production (i.e. cost minimising) will be the same.

Another example that is relevant here would be a unique resource endowment, perhaps a raw material source or a business location advantage, that other firms cannot match. Yet another example would be constraints on production imposed by public policy-making bodies or union contracts. For example, if it is forbidden in one country to discharge certain wastes into the atmosphere through a factory chimney, it could change the minimum cost production techniques in one country, while not affecting other countries which do not have such regulations. The same principle might apply to quotas for hiring disabled persons.

Third, it may be that the owners of the capital employed by the firm (whether public or private) do not demand that profits be maximised, and hence are willing to settle for a lower return on their investment than is actually possible. Labour could also make the same decision, namely that they would prefer to see a few more people employed by restraining their wage demands over the maximum that might be attainable. These differences can be particularly significant when making comparisons across national borders and between cultures.

Any of these circumstances can account for discrepancies between production techniques in use at a particular time, across organisations or across nations. However, in export-oriented mass markets it is obvious that productive technologies are much more alike than different. Furthermore, it is clear that one strong international competitor with superior production technology can threaten the very existence of less efficient firms. Thus, one can expect that in the current export-oriented world new process innovations are likely to spread rapidly to the extent of the market.

The employment impact of particular technologies depends upon the specific effects on the labour inputs for a given volume of output, plus the output effect that results from broader market forces. For instance, the process innovation may displace a segment of the previously employed labour force, but price reductions or quality changes in the product may cause increases in output that make up the difference, so that total employment does not change. It is the complexity of these interactions that make it very difficult to determine the net impact on employment in advance of implementation. It is even difficult to extricate the influence of the various forces in retrospect.

One of the best studies of the employment impacts of a specific process innovation was a study of Bell Canada on the implementation of direct long-distance dialling over the period 1952 to 1972 (Denny and Fuss, 1983). Using the percentage of all long-distance calls accounted for by direct long-distance dialling and consulting careful records of capital investment and employment kept for four specific occupations (operators, plant craftsmen, clerical workers, and other white-collar workers), Denny and Fuss were able to determine that this technological change substantially increased the amount of capital and reduced the amount of labour used per unit of output. Further, the labour-saving effects were most pronounced in the lower-skilled occupations. However, they also found that the overall employment impact of direct long-distance dialling was *positive*, owing to the substantially lower costs that led to

phenomenal output growth. So even though the process innovation involved a large substitution of capital for labour, the overall employment impact was positive. Of course, the workforce needed to produce the 1972 output with 1952 methods would have been much larger, but the 1972 output would not have been demanded by consumers in the first place without the major price reductions made possible by the process technology innovation.

Another study with similar findings was that of Levy, Bowes and Jondrow (1984). They studied the impact of technological change from 1960 to 1980 in the steel, aluminium, motor vehicle, coalmining and iron-mining industries in the United States. In each industry, technological change led to the substitution of capital for labour, although technological change was rather minimal for the steel industry. However, in three of the five industries (coalmining, iron-mining and aluminium manufacturing), the indirect effects of the process innovation were sufficient to increase total employment. In the steel and motor vehicle industries, on the other hand, demand growth was not sufficient to offset the direct labour-displacing effects of process innovations over the 20-year period.

Another study from the United States analysed the employment effects of technological change using a technique called input-output analysis to decompose the growth in employment from 1972 to 1984 in 79 industries (Young and Lawson, 1986). A hypothetical use of the input "recipes" from 1972 to produce 1984 output was compared with the actual inputs needed in 1984. The difference represents the change in inputs because of process innovations and input price changes. During the period studied, the authors concluded that technological change alone would have reduced employment in 65 of the 79 industries, but in two-thirds of the industries (44 out of 65) employment actually increased because of countervailing output trends.

There is a group of studies from the United Kingdom, known collectively as the Technological Trends and Employment Project (TEMPO) of the Science Policy Research Unit at the University of Sussex (Clark, 1985; Freeman, 1985; Guy, 1984; Smith, 1986; Soete, 1985). This project studied the impact on employment of technological change and productivity growth in 17 British manufacturing and service industries and then used the results to forecast the prospective employment levels of these industries for the decade of the 1990s. A primary role was assigned to capital investment, and strong assumptions were made about the productivity impact of these investments. The projected employment growth numbers of the 17 sectors were generally low, or even negative. However, this is fairly typical of prospective forecasts of occupational employment impacts of technological change. But the real message that emerges from these British studies as well is that the employment effects of technological change are very complex, and difficult if not impossible to anticipate in advance.

The consensus of those studying the employment impacts of technological change is that technology is labour-saving, and hence labour-displacing, in the first instance. However, the indirect price and income effects of technological change soon mitigate this impact. The increasing productivity that

technological change makes possible also allows rising incomes and a rising standard of living for those workers who are still employed. Workers whose wages rise find themselves able to spend more, and this in turn creates more jobs for workers in other industries. In the short term, it always looks as though technological change is going to produce a serious decline in employment; but, after all aggregate adjustments have taken place, we usually find more people at work, and at higher wages, than before.

Reflecting the uncertainty involved in analysing the aggregate employment impacts of technological change, there is even less consensus about the specific impact of technological change on occupational employment distributions. Process innovations throughout the industrial age have obviously involved the substitution of machine power for human or animal labour. In general, more and more of the skill required for production (especially in manufacturing) has been imbedded in the capital goods rather than in the workers' skills. The innovation of assembly-line production in the early years of the twentieth century brought this development to its natural conclusion. Henry Ford is alleged to have claimed that his goal was to make every job on the line so simple that it could be learned in 30 minutes or less. Thus, the workers become interchangeable parts just like the products they produce.

However, in recent years, the increasing complexity of manufacturing processes and the increasingly sophisticated skills needed to keep those processes operating effectively may have led to a reversal in these trends. In a review of 200 case studies of process innovations over the period 1940 to 1982, Flynn (1985) concluded that the overall impact of process innovations on occupational employment was indeterminate, depending on the precise conditions within individual industries, or even individual firms. Spenner (1986) also reached the same conclusion on the basis of a review of a much smaller number of studies. He found no convincing evidence to support broad claims of either reductions or increases in overall skill levels.

However, in a review of the employment implications of a single process innovation (the introduction of industrial robots), Hunt and Hunt argued that a "skill-twist" characterised this innovation: that the jobs created by the spread of robotics required more skill than the jobs that were being eliminated (many of those being assembly-line jobs). "The new jobs will require much more technical background than manufacturing jobs in the past" (Hunt and Hunt, 1983, p. 176).

At the same time, there has been a remarkable increase in white-collar and service employment over the past 40 years in the advanced Western economies. Traditionally, these jobs have been less susceptible to labour-displacing process changes than manufacturing jobs, partly because their productive processes have been somewhat simpler.[3] However, in the past few decades,

[3] They have had substantially less capital equipment per worker. A recent study by the United States Office of Technology Assessment found that workers in the finance industry had about one-third of the capital of the average worker in manufacturing (Office of Technology Assessment, 1985).

there have been rapid changes, particularly since the introduction of the microprocessor. Certainly, the computer revolution has changed the way most white-collar workers collect, use and distribute data.[4]

In general, it seems that the new microprocessor innovations are being used to extend workers' capabilities rather than reduce job requirements. While the recent introduction of "smart" point-of-sale terminals looks like the classic displacement process, putting the intelligence into the tool and reducing the skill required of the worker, this has been less characteristic of white-collar automation. Thus, jobs today seem to be much more demanding in terms of schooling, even though the average manufacturing job may involve less "skill" than before.

Cyert and Mowery concluded that the substantial body of literature on the skill impacts of technological change had reached few consistent conclusions. They offered the following reasons for this seeming futility:

(1) the methodologies and data used in studies of technological change and skills are weak and imprecise;

(2) there is little agreement on the definition (and therefore the measurement) of job-related skills. Analysts often disagree on whether skills are an attribute of individuals (in which case they would be related to educational attainment and would be portable among jobs) or whether they are highly specific to firms or occupations and only loosely related to educational attainment;

(3) case studies of the impacts on skills of specific technologies or of technological change within a specific industry rarely consider a lengthy period of time; thus, they are unable to trace changes in skill requirements as a technology, industry or production process passes through different stages of its development or diffusion; and

(4) the skill effects of technological change are sensitive to the ways in which new technologies are implemented in the workplace. Managers have considerable discretion in such implementation, which may affect skill requirements. Thus, identical innovations introduced in different firms can alter skill requirements in different ways (Cyert and Mowery, 1987, p. 100).

In short, there is no simple unassailable truth about the impact of technological change in general on skill levels or even on occupational employment levels. The impacts of individual innovations can be highly significant, but they are impossible to predict in advance, and so far have even proved very difficult to analyse after the fact.

However, it does seem clear that the work that is left for humans to do is becoming less physically intensive with every passing year. This is both because of increasing mechanisation and automation in manufacturing and

[4] See Hartmann, Kraut and Tilly (1986) for a review of historical patterns of technological change in office jobs.

because there are relatively fewer manufacturing jobs. Certainly, any trend that increases the pay-off to reasoning skills and reduces the pay-off to physical manipulation would benefit individuals with physical handicaps. Thus, the evolution of the job structure over the recent past might be expected to favour the skills of some disabled persons.

## *Implications for disabled persons*

Persons with disabilities are obviously as different among themselves as are persons without disabilities, so there is no simple summary judgement as to the implications of technological change for their employment prospects either. Clearly, the employment trends accompanying technological change have different implications for people of different skills. However, as the job content changes from making things to handling information, from blue-collar manufacturing jobs to white-collar service jobs, from brawn to brains, the relative employment prospect for physically disabled people appears to improve. Other things being equal, to the extent that human manipulation has been replaced by machine power, those with motor limitations should be relatively more competitive in the general labour market. The individual cases discussed in the following chapters are heartening in that regard.

It seems clear that, for people with limitations in their motor capabilities, the structural changes of the past few decades in Western economies have also been a positive force. The replacement of the manufacturing economy of the early twentieth century with the service economy of the late twentieth century also promises better outcomes for disabled persons. While hard evidence is lacking, the job content appears generally to be evolving in ways that reduce the significance of mobility restrictions and physical manipulation limitations and increase the importance of scientific knowledge, concentration on detail and data manipulation. To the extent that the jobs available require skills that disabled persons are more likely to possess, we should expect the job market outcome to be improved. Of course, this assumes that such individuals have access to the training needed to acquire the skills necessary to qualify for these jobs in the first instance, and that they are treated in a fair and non-discriminatory manner in the labour market.

There are other hopeful signs in the labour market as well. First, the lower birth rate after the baby boom of the 1960s will clearly affect the labour market. In the United States it is already doing so; in some other parts of the world it is still pending. The smaller cohorts coming of age through the 1990s will create a different labour market from that of the 1970s and 1980s.[5] We may not approach a true "labour shortage" in all labour markets, or in all occupations, but the *relative* change should be easily discernible. With a smaller supply of labour, it is logical to expect that workers who may have been passed

[5] Two excellent works on labour force dynamics and their consequences in the United States are Easterlin (1980) and Levy (1987).

over before because of some physical or mental handicap will be more favourably evaluated. Thus, the labour force dynamics of the next two decades will also increase the relative employment prospects of disabled people, again provided that they have the skills required by the new job opportunities. Skill training for disabled persons is considered in Part II below.

The third great future advantage for disabled people is assistive technology. To the extent that the microprocessor revolution and other technological improvements can be harnessed to improve the productivity of individual disabled people, or to enable *them* to substitute capital for labour, a new and exciting age of productivity may be dawning for them. At present there is not nearly enough funding for research to solve individual problems or to disseminate proven engineering solutions to meet the challenges of disability.[6] However, the exciting work of the Swedes in the TUFFA project discussed in Chapter 6 points the way to a more promising future for disabled people.

The labour shortage will make disabled persons more valuable as a source of labour supply, and the improvement of assistive technology will make it more feasible to neutralise the original sources of their disadvantages. Thus we shall have both the need and the means to make fundamental changes in the employment picture for disabled persons over the next 20 years. The evidence presented below in Part IV demonstrates that we have a very long way to go before we reach the promised land. But these possibilities are now in place, and the time to prepare for the future is now, before it is upon us. If we can develop the collective will to make these miracles happen, it can be done.

We shall return to a consideration of the policy issues in Chapter 12 after all the evidence has been presented. Then it will be time to bring our collective observations together and to draw appropriate conclusions and recommendations.

[6] Only now is a start being made in the United States, through the efforts of the Request Rehabilitation Engineering Center at the National Rehabilitation Hospital in Washington, DC. The Center has secured funding from the National Institute on Disability and Rehabilitation Research from the United States Department of Education to review assistive technology and provide standardised evaluative information to consumers and manufacturers in an effort to make the market for assistive technology work more effectively.

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# Part II. New technology training programmes for disabled persons

# 3

## New technology training programmes for disabled persons in Great Britain[1]

*Paul Cornes, PhD[2], Michael Floyd, PhD[3] and Georg Boeckenfoerde[4]*

Our objective is to review a cross-section of British provision for training disabled persons for employment using new technologies (NT).[5] To place this review in context, we begin with a brief examination of the British system of vocational training for disabled persons.

In most European countries vocational training for disabled people is provided mainly in specialised centres segregated from mainstream vocational training. This contrasts with the approach adopted in Great Britain, where, until quite recently, the pattern of provision has followed the blueprint for the development of rehabilitation, training and employment services for disabled people in the postwar years laid down by the Tomlinson Committee (1943). That Committee – whose recommendations formed the basis for the Disabled Persons (Employment) Act, 1944 – considered that specialised (residential) vocational training would be required by just a minority of disabled people. The majority were expected to pursue training on an integrated basis, alongside non-disabled people in employers' training programmes or mainstream courses provided by the national network of government training centres (later called "skillcentres") or colleges of further education.

Such arrangements never catered satisfactorily for the whole range of demand, so that some voluntary organisations, usually those concerned with specific disabilities, developed their own training programmes. The Tomlinson blueprint for integrated provision, however, exerted a strong influence on subsequent developments. Consequently, the number of places in the country's four residential training colleges for adults with non-sensory disabilities has remained relatively static over the years, increasing slightly to around 900 some 20 years ago and approximately 1,250 today. In contrast, the number

[1] i.e. United Kingdom without Northern Ireland.

[2] University of Edinburgh.

[3] City University, London.

[4] University of Witten/Herdecke, Germany.

[5] The authors wish to acknowledge their indebtedness to all respondents to the survey (listed in the annex) and, in particular, to those who also hosted fieldwork visits. Completion of the survey was made possible by support from Rehabilitation International, New York; the ERTOMIS Foundation, Wuppertal and the Association of British Insurers, London. That support is also gratefully acknowledged.

of disabled adults in other, mainly integrated training programmes has increased substantially from around 2,000 some 20 years ago and 4,000 ten years ago to over 50,000 in 1989-90 (Manpower Services Commission, 1982; Department of Employment, 1990). A small but increasing proportion of these are being trained for employment using NT.

The dramatic expansion of the number of disabled people receiving vocational training during the past decade is a consequence of fundamental changes in the British labour market since the mid-1970s. These have been associated with automation, the advent of science-based industries, the introduction of NT, the decline of traditional primary and manufacturing sectors in contrast with a burgeoning service sector, and high levels of structural unemployment (Cornes, 1984), from which the national economy has only recently begun to recover. One general feature of this period of upheaval and transition has been that employers have tended to invest much less in training, with that burden transferring to the State, whose role in vocational training expanded substantially through a proliferation of new programmes for young people, long-term unemployed adults and other marginalised groups, including disabled persons.

## Recent changes in provision

By 1987-88, almost 1 million young persons and adults were entering such programmes each year. Therefore, in some measure, the substantial increase in the number of disabled people entering vocational training during the past decade reflects this change in the general availability of training opportunities. Other contributory factors may include changing aspirations, especially on the part of some more severely handicapped persons, new opportunities created by the availability of NT, and changes in rules governing entitlement to benefit which permit persons in receipt of invalidity benefit to enter training without sacrificing entitlement to such generally higher-rated sources of social security income. The last change, associated with a government decision to waive for disabled applicants a further requirement that entrants must have been unemployed for a minimum of six months before commencing the programme, may explain why the Employment Training Programme (and its Community Programme predecessor) has attracted such a high number of disabled people. These changes have certainly removed some disincentives which previously discouraged some disabled people from taking steps towards returning to work.

Between 1987 and late 1990 there were signs of stabilisation and recovery in the economy, associated with a progressive, if modest, downturn in the number of unemployed persons. This prompted the Department of Employment to reconsider the employers' role in vocational training and the extent to which public programmes should meet current and future demand for labour. As a result of recent legislation, from late 1990 onwards, following the introduction of a network of 82 employer-led Training and Enterprise Companies

(TECs) in England and Wales and 14 similarly headed Local Enterprise Companies (LECs) in Scotland, employers will be administering publicly funded, local programmes for vocational training and enterprise creation in their localities.

It remains to be seen how effective these new arrangements will be. Nevertheless, it is important to note that this project has been undertaken against a background of considerable concern on the part of providers of training for disabled people over the extent to which their trainees will be able to take advantage of the proposed changes. Fewer than one in four employers comply with the requirements of the quota scheme, which obliges employers with 20 or more employees to have 3 per cent of registered disabled persons in their workforces. The abolition of the scheme has been mooted in a recent Department of Employment review of policy and services (Department of Employment, 1990), although no evidence whatsoever has been produced to demonstrate the effectiveness of an alternative voluntary approach. Thus providers of vocational training for disabled people are understandably concerned to ensure that their trainees' needs are not overlooked under a new system. This is likely to be less generously financed and less able to "guarantee" stable funding arrangements and hence continuity of training programmes. There is undoubtedly some justification for the widely held belief that, in future, there will be a strong temptation for TEC and LEC purchasers of vocational training to be guided more by considerations of cost than by effectiveness.

Potentially, these problems apply to all types of training for disabled people, not least because it has been apparent from official reports that disabled people have always been underrepresented in employer-led training programmes, which are considered more likely to attract continuing support under the new arrangements. A recent unpublished study (Pilling et al., 1990) suggests that, as with the earlier Community Programme, providers of Employment Training were seen by referring agencies as falling into two quite distinct categories:

(1) "caring" providers, which had a high proportion of disabled trainees with disabilities, and where on-the-job training was offered mainly on projects run by the provider; and

(2) "employer-based" providers, where such training was usually offered on employer placements and was therefore more relevant and more likely to result in the trainee being offered a proper job at the end of the training.

Few disabled trainees were, however, accepted by these latter providers. There may be additional difficulties where NT training for such persons is concerned because there is little evidence of employer involvement in this area. This is illustrated by the experience of the IT Support for Disabled Persons project launched by the British Computer Society in 1988 to demonstrate to employers how information technology can help disabled people at work. At the launch of this project, it was expected that it would be principally

concerned with the provision of information and advice on practical and technical matters. However, quarterly newsletters from the project suggest that, while some progress has been made in this respect, practical and technical problems have demanded much less attention than has the marketing of the abilities and potential of disabled persons in order to help them to gain better access to relevant training and employment opportunities. Technology is not perceived to be the main problem and is expected to become of even less importance as computer manufacturers are persuaded to produce more accessible equipment. In this respect, the experience of the British Computer Society project is consistent with other studies (Cornes, 1988) which have suggested that employers' attitudes, practices and procedures may constitute more difficult obstacles to further progress than technological aspects.

## Objectives

This project presented an opportunity to explore some of these issues through a state-of-the-art review of a cross-section of British provision for training disabled people for employment using NT. The brief for the project directed that, in addition to a general assessment of programmes in the light of their objectives, attention should be paid to the following topics: methods and criteria used to select the training area; techniques used to finance the training programme, including costs of equipment; the selection of applicants for the programme, including aptitude tests, income eligibility requirements, disability requirements, job status; problems encountered in implementing the programme; the role of social partners such as employers' organisations and trade unions in shaping programmes; and outcome data, if available.

## Procedure

This brief was implemented in three stages. A first stage comprises a review of the main phases of development in the provision of training programmes for disabled people, noting the main agencies involved and the extent of their commitment to providing NT training. This review revealed that most initiatives of this kind were led by the voluntary sector, with a smaller number of courses provided by residential training colleges for disabled people, colleges of further education or agencies acting under central and local government auspices. No evidence was found to suggest that employers are as yet extensively involved, although an increasing number appear willing to consider and to become involved with individual cases.

The information obtained suggested that training programmes differ widely in aims, scope and resources, as well as in other ways. More importantly, undertaking the review demonstrated that there was no centralised source of information providing guidance on the training programmes available, entry requirements, syllabi, possible sources of support or success rates. The second

stage of this project therefore comprised a survey of these programmes. This was undertaken in two phases: telephone interviews with ten programme providers, on which an interim report was based (Cornes, Floyd and Boeckenfoerde, 1990); and a postal survey of 37 other providers. Altogether, information was obtained about 40 out of 47 (85 per cent) of the targeted programmes. With no master list available, it was not possible to check the representativeness of this sample. While all residential training centres and larger voluntary organisation programmes are included in the study, it is possible that other types of training provider may not be as fully represented.

Hospital-based programmes, such as those commonly found in spinal injury units which aim to introduce patients to the use of personal computers, and other programmes, such as those using information technology to facilitate therapy or the social training of persons with mental handicap (retardation), were excluded from consideration.

Respondents were invited to answer a series of questions about the content, nature, duration and objectives of training programmes; other facilities and support programmes; staff; trainees; outcomes of training; liaison with other organisations; and funding arrangements. These mainly quantitative data were coded and analysed: (a) for all respondents; (b) for seven different types of programme; and (c) for the ten most and ten least successful programmes, as judged by reported placement rates.

Finally, to gain a broader, qualitative appreciation of the training programmes, a third stage of investigation was undertaken, involving visits lasting between one and three days to five programmes selected to be representative of the whole range of survey respondents. These visits were used to validate replies to the survey and to pursue some aspects in greater depth through discussion with managers, training staff and trainees.

## Results

### *The training providers*

The 40 training providers offered a total of approximately 2,150 places for training in NT skills. The number of places available ranged from five to 220, with a mean of 54 and a median of 30. Apart from one centre which had provided training in electronics from the mid-1970s, all NT training programmes had been set up during the past decade. Four were established before 1983, 20 between 1983 and 1987, and 16 from 1988 onwards.

Analysis of replies suggested that providers could be grouped into seven categories.

*Residential training colleges* (n = 7). This group includes four residential colleges which cater mainly for persons with physical disabilities, two which specialise in the training of blind persons and one which concentrates on

training persons with hearing problems. These centres provide an average of 86 places for NT training and generally offer such training as just one aspect of more wide-ranging programmes embracing other skills. They are also by far the longest-established providers. Most have more than 40 years of experience in providing vocational training for disabled people.

*Large voluntary organisations* (n = 8). This group of training providers also caters for persons with a wide range of mainly non-sensory disabilities, with one concentrating specifically on persons with histories of mental illness. All are of comparatively recent origin, having opened within the past ten years. Apart from one organisation, which is entirely concerned with the provision of training (and employment) in a range of modern office-based skills in an expanding number of different locations, all others provide NT training as part of a wider range of training for other skills. The average number of NT training places in these organisations is 69.

*Small voluntary organisations* (n = 6). With one exception, all these providers are of very recent origin, having commenced operations within two years of the date of the survey. Three concentrate on the training of persons with specific disabilities and three cater for persons with a mix of disabilities. Four are concerned only with NT training, the other two also provide training in different activities. There is an average of 20 places for NT training in these six programmes.

*Hospital-linked organisations* (n = 3). All three of these providers cater for former psychiatric hospital in-patients, the majority of whom had been long-stay. Two are closely associated with particular hospitals, the other trains persons from a variety of sources. The average number of places on these programmes is 15.

*Local authority-based providers* (n = 4). The four providers in this category have strong links with local authority social services departments. They provide an average of 35 places. Three cater for various non-sensory disabilities and one provides courses only for former patients of psychiatric services. Two concentrate only on information technology training and two provide such training alongside training for other activities. All are concerned with orientation- or work preparation-level training in readiness for progression to higher-level training either on the job or on other training programmes.

*Further and higher education-based providers* (n = 8). In this category there are three providers based in polytechnics, five linked to other further education establishments and one associated with a university extra-mural department. One caters only for deaf students, the others for students with a variety of disabilities. While most cater for persons from local catchment areas, one – based on open learning/training principles – provides home-delivered training in widely scattered locations. The average number of places provided by these programmes is 54.

*Other providers* (n = 4). These providers include two Information Technology Centres (ITeCs), an Assessment for Employment and Training (ASSET) Centre and an Employment Training provider which caters for a very high proportion of disabled people. The average number of places is 40, although one provider accounts for 125 of the 160 places provided by these four organisations.

## *The trainees*

An analysis of data about trainees revealed that 60 per cent were male and 40 per cent were female. Seventeen per cent were below 21 years of age and 21 per cent were 41 years or older. Three-fifths were between 21 and 40 years of age (43 per cent between 21 and 30 and 18 per cent between 31 and 40 years). Compared with the average for all providers, males were overrepresented in residential centres, local authority-based programmes and further education-based providers. Higher than average proportions of women were found in voluntary organisation providers (large and small) and hospital-linked providers. Persons attending residential training centres were of a similar age distribution to the sample as a whole. However, the larger voluntary organisations and further education-based providers appeared to attract higher than average proportions of younger persons, with the small voluntary organisations, hospital and local authority-based providers catering for more of the older trainees. The latter appear to be persons who, through disablement, are obliged to make a transition from manual to "white-collar" employment.

Trainees were described as having a very wide range of disabling conditions. Those most frequently mentioned include blindness, other visual handicap, deafness, mental illness, neurological and rheumatological disorders, orthopaedic problems (including spinal cord injury), cerebral palsy, spina bifida, muscular dystrophy and cancer. While some providers cater for persons with learning disabilities and mental handicap (retardation), generally provision for such persons is limited. It is also noteworthy that persons with cognitive disabilities associated with traumatic brain injury were not mentioned by any of the providers.

The returns from all providers reveal that three-fifths (59 per cent) of all trainees had physical disabilities, 16 per cent had experienced various kinds of psychiatric disorder, 14 per cent had sensory disabilities and 11 per cent had learning or developmental disabilities. Persons with physical disabilities were overrepresented in residential centres, where they comprised two-thirds of all trainees, and further education-based providers, where they accounted for three-quarters of the total. They were least well represented in Department of Employment providers. Not surprisingly, in view of the location of specialist courses for trainees with sensory disabilities, such persons were most often catered for in residential centres or further education-based providers, and comprised only a small proportion of the clientele of other programmes.

The opposite pattern tended to prevail for persons with histories of psychiatric disorder who were found to be quite underrepresented in residential centres, further education-based and large voluntary organisation providers. Their training needs were much more likely to be catered for by hospital-linked providers (provided only for such persons), and by Department of Employment and small voluntary organisation providers, where such persons accounted for around one-third of all trainees. Persons with learning disabilities predominated in larger voluntary organisation and Department of Employment providers, where they represented between a quarter and a fifth of all trainees, respectively. They comprised only a very small proportion (less than 5 per cent) of the clientele of all other providers. The information about persons with learning disabilities should not be confused with other information about the number of persons who, on entry to training, are found to have low levels of literacy and/or numeracy which require remedial attention before they are able to benefit fully from training in specific skills. Respondents expressed considerable concern about the extent of the latter problems. Although it was not possible to obtain a precise estimate, it would appear that at least a quarter to a third of all trainees are additionally handicapped by poor literacy and/or numeracy.

## *The trainers*

Forty providers, who responded to the survey, employ the equivalent of 246 full-time staff who are deployed on NT training. The actual number differs from provider to provider, depending upon their nature and size, varying from one, at an ITeC, to 23 at one of the large voluntary organisations. The average number of staff per provider is six. However, only 12 providers are staffed by eight or more trainers and half have three or fewer. The overall ratio of trainers to trainees is 1:7, but generally that ratio is lower in residential centres (1:4) than in non-residential ones (1:8).

These trainers are drawn from a variety of backgrounds, including engineering and technology, electronics, computing, business, occupational psychology and, in one instance, psychiatry. In some cases, training staff are able to call upon other sources of professional expertise when required. Staff in other providers with more limited resources have to operate without such back-up. Qualifications of staff range from trade or technical certificates to postgraduate and professional level. While 70 per cent have teacher or instructor qualifications, only a third of respondents reported that their staff hold formal qualifications in information technology. There are no significant differences in the level of qualifications held by staff providing courses in different types of training organisation. However, staff in the ten providers with highest placement rates, on average, hold a larger number of qualifications than those working in other providers.

## The training courses

Training providers are located in all parts of Great Britain, generally in or near large centres of population and with London and the south-east better catered for than other regions. All focus mainly on training in information technology-based skills, and all but three – the two ITeCs and the Employment Training provider – cater only for disabled people. Some further education establishments provide special courses attended only by such persons. The survey therefore does not embrace other disabled persons who receive training alongside non-disabled peers on a more integrated basis or, with one exception, those who are trained under home-based and/or open learning arrangements.

## Entry qualifications and assessment of training needs

All but five programmes do not specify entry qualifications, and all but four reported that they rely on in-house procedures to assess suitability for training and to assess trainees' needs. Thus, in addition to preliminary screening, most training providers undertake further assessment, usually as an aspect of induction programmes which vary in length from two days to several weeks. These periods of induction training are also frequently used to assess trainees' personal qualities, such as their interest, motivation and ability to get on with staff and other trainees. Even where entry qualifications are specified, they are not pitched at a high level: three programmes require trainees to possess basic literacy and numeracy, one asks for previous experience of office work, and one expects entrants to possess some experience in keyboard use.

Twenty-eight providers accept persons with a mixture of physical, psycho-social, learning and mental disabilities and 12 cater only for persons with particular disabilities. The latter include seven for persons recovering from psychiatric illness, two for trainees who are blind or partially sighted, two for deaf trainees and one for persons with cerebral palsy. Apart from one residential centre for young men, all accept applications from both males and females. With that exception, none debars applications on grounds of gender or race (which would be illegal), although one declared a policy of positive discrimination in favour of women and persons from ethnic minorities (in particular those from Afro-Caribbean and Asian backgrounds). Seventeen are prepared to accept trainees at any age between school leaving and retirement, and 23 set upper age limits. The latter include two providers which concentrate on persons under 23 years and two which accepted persons under 25 years. In most other cases, upper age limits were set between 50 and 60 years, mainly the latter.

## *Referral procedures*

Limited information about referral suggests that there is no uniform procedure. Disablement Resettlement Officers (DROs), based in Department of Employment Jobcentres, appear to be quite frequently involved in referrals to well-established, full-time providers at which most, if not all, trainees' attendance is funded by the Employment Training programme. DROs are much less frequently involved in referrals to other mainly education-linked or part-time providers, for which attendance is often mediated by voluntary organisations, health or social services, the careers service, or, even less formally, by word of mouth.

## *Course occupancy*

With 33 providers reporting full occupancy of training places at the time of the survey, only seven were able to offer immediate entry to suitable applicants. For fully occupied courses, waiting lists are maintained, with waiting times before places are available ranging from less than one month to more than one year, with a median of three months. Such periods are determined by various factors, including the popularity of courses, whether training places are filled on a "roll-off, roll-on" basis or whether courses start at fixed intervals, which may vary between two months and, in the case of [illegible]e further and higher education-linked courses, one year. Generally, however, where courses are provided on a "roll-off, roll-on" basis or where there are monthly or quarterly starts, waiting lists are shorter than for courses which are provided at six-monthly or yearly intervals.

## *Scope of training*

As might be anticipated from previous information about entry qualifications, most training commences at an elementary level with an introduction to computer use and/or computer literacy. In the case of some providers, trainees do not progress beyond this introductory level, but in others training progresses on to entry-level office skills (29 providers), elementary programming (25), graphics software (14) and business practice packages for accountancy, payroll procedures, stock control, etc. (12). Some providers offer high-level training in these skills and some also offer training in other NT applications in such fields as engineering and design, including computer-aided design (7), electronics (6), computer maintenance (2), telecommunications and technology transfer, video production and editing and higher-level computer programming (one provider each).

The predominance of information technology-based office skills is also evident from the range of personal computer-based skills for which training is offered. From this perspective, all 40 respondents introduce trainees to word-

processing operations; 33 provide training in use of spreadsheets and database management; and 28 reported that training includes aspects of desktop publishing. In the majority of cases, training is based on the operation of stand-alone personal computers. Others, including residential centres, one of the large voluntary organisations and some of the further and higher education-based providers, have computer systems of differing degrees of sophistication: some, if not all, trainees are introduced to the operation of these. Generally, they are also the longer-established providers with more formally structured, full-time courses providing training for higher-level skills and qualifications.

## *Nature and duration of training*

Of the 40 training providers, 20 provide full-time courses only, 12 are part-time only and eight offer a mixture of full-time and part-time places. The duration of training courses varies not only between providers but also within individual settings, when courses can be tailored to individual requirements and rates of progress or when different courses are available. The minimum period of training offered is two months and the maximum is 36 months, with a median of 12 months. Altogether, 46 per cent of courses are for periods of up to nine months, 48 per cent are for 12 months and 6 per cent for periods of more than one year. However, most respondents indicated a readiness to be flexible about course length and 84 per cent stated that they would be prepared to extend training periods if necessary.

The predominance of 12-month courses reflects the dependence of many trainees on the Employment Training programme for funding. Those training under this scheme can be receiving either state unemployment benefit or – as is more likely in the case of people with disabilities – the higher-rated invalidity benefit. In both instances, entry to Employment Training attracts an additional premium payment of £10 per week and assistance with travel expenses, if they exceed a specified amount that trainees are expected to meet out of their own pockets. In the case of persons undergoing part-time training, it is most likely that they are proceeding under the "21-hour rule", with entitlement to benefit unaffected but with no additional assistance available.

## *Training method*

Eleven providers – generally from smaller programmes linked to voluntary, health service or social service organisations which are providing part-time training with as much emphasis on therapeutic as vocational objectives – reported that training is provided mainly on an individual basis. Ten providers reported a reliance on group methods, with the other 19 providers using both individual and group methods. Where trainees are instructed in groups, the size of groups varies from two or three to a maximum of 17. The average number of trainees in a group, however, is eight.

## *Supplementary training and assistance*

Interviews and questionnaire returns highlighted the extent to which training providers need to pay attention to much more than the purely vocational aspects of training. Besides the significant proportion of trainees who need remedial help with basic numeracy and literacy, others are considered to require additional assistance to enhance communication skills, self-confidence or self-esteem and other social skills. No fewer than 23 courses include social skills training sessions or modules. Other help includes training in job-search skills and the arrangement of placements to enable trainees to gain work experience, both of which are offered by 35 providers.

## *Training standards*

Six respondents stated that trainees are not prepared for specific formal qualifications. The remaining 34 training providers encourage trainees to prepare for a wide range of examinations. In order of frequency these include: Royal Society of Arts, 25 programmes; City and Guilds, 15; National Certificate of Vocational Qualification (NCVQ), 10; Pitman's, 10; General Certificate of Secondary Education, 8; London Chamber of Commerce, 6; Scotvec, 2; and Business and Technical Education Council (BTEC), 2. In addition, two providers issue their own certificates of competence and five providers prepare trainees for six other, less widely recognised qualifications.

The range of Royal Society of Arts and Pitman's examinations suggests that most courses prepare trainees for entry-level word-processing and data-processing tasks or, in some cases, prepare them for higher-level training. Other examinations, based on City and Guilds, NCVQ, Scotvec or BTEC syllabuses, are pitched at a higher level of technical competence and embrace a wider range of skills in, for example, information technology, computer programming, micro-electronics, engineering and design, business administration and printing and graphics. While training in basic entry-level skills is provided by all training providers, higher-level training tends to be concentrated in larger, longer-established, full-time training settings such as the residential colleges or further and higher education-linked courses.

## *Effectiveness of training*

With training provided at different levels, ranging from work preparation to professional, and with different objectives, ranging from therapeutic to vocational, there are no universally applicable measures of effectiveness. However, the proportions of trainees securing qualifications and moving into employment on completion of training are two broad outcome measures which can be used for this purpose.

Information about examination pass rates was not supplied by all respondents. In addition to the six providers which did not encourage trainees to obtain formal qualifications, other programmes were of too recent origin to be able to supply this information. The 26 providers who were able to answer this question reported proportions of trainees who gain qualifications ranging between 20 per cent and 100 per cent, with a median of 80 per cent and a mean of 77 per cent. The most encouraging feature of these outcomes is that they do not seem to be influenced by the level of training provided. High pass rates are reported for both entry-level and higher skills. Lower pass rates tend to be associated with part-time, therapeutically oriented courses for persons recovering from psychiatric illness or other courses with higher than average proportions of persons with such disabilities, although some programmes for persons in this category do achieve better results.

Six providers were unable to give information about the proportion of trainees who gained employment after training. In three cases they were comparatively new programmes which could not supply the requisite information. In two cases, providers operated on a "walk-in" basis and no follow-up information was available. In the other case, the provider declined to answer on the grounds that its course was "pre-vocational". The remaining 34 providers reported proportions of former trainees in employment ranging from 10 per cent to 90 per cent, with a median of 65 per cent and a mean of 57 per cent.

Ten providers reported employment rates of less than 50 per cent; 12 reported rates of between 50 per cent and 74 per cent; and 12 reported rates of 75 per cent or more. Half the group with lowest placement rates train persons with histories of mental illness (with other programmes of this kind in the middle band). Other providers in the low placement group include those with a strongly therapeutic orientation, which specialise in helping people with very severe physical disabilities, and larger voluntary organisation and local authority-based programmes with strong vocational objectives, but which are located in regions with very high unemployment rates. Highest placement rates are recorded for seven residential training colleges for persons with physical or sensory disabilities, two further or higher education-based programmes and two large voluntary organisations which are very clearly committed to vocational rehabilitation. Another distinction between programme providers with low and high employment rates concerns the level of training provided. Low rates are associated with providers of part-time courses focusing on entry-level skills; high rates are associated almost exclusively with providers offering full-time training in higher-level skills.

All providers stated that they obtained feedback from former trainees, 30 on an informal basis and ten through more formal follow-up inquiries. At a mainly informal level, therefore, all providers were able to comment on trainees' attitudes towards, and/or expressed satisfaction with, their training courses. These reports suggest that trainees appreciate the opportunities they have received and the enthusiasm and self-confidence that training has engendered. Those attending under the "21-hour rule" do so on an entirely voluntary basis, and others attending under Employment Training programme arrange-

ments have often spent a long time previously unemployed and unable to obtain training through other avenues. When linked to their ambition to move into employment, this may explain the generally high levels of positive feedback.

## *Funding arrangements*

The 40 training providers have three principal sources of finance: 26 are funded by the Department of Employment under the Employment Training programme; 19 are funded from local government social service and/or education department budgets; and 13 are funded from the European Social Fund. Most providers rely on more than one source of finance. No fewer than 17 contributed to their finances through their own fund-raising activities, contract work or the sale of assessment and training services to employers. Other less frequently available sources of funding included charitable donations (7); local health authorities (6, mainly for former psychiatric hospital patients); private company sponsorship (4); and Department of the Environment urban aid budgets (3).

There is therefore no common basis for funding these programmes. In almost all cases, trainees' income derives from state benefits (e.g. training allowance, unemployment or invalidity benefit and/or social security payments). In the case of residential training, central government subventions provide for substantial elements of related staff costs and capital expenditure. In the case of local authority-based programmes, similar assistance is available from local government funds, and most voluntary organisation programmes have more variable and less stable sources of funding – relying on legacies, donations and fund-raising activities as well as grants from local and central government sources. While the European Social Fund has been very important in this sphere, recipients of funding from this source expressed considerable concern over slowness on the part of the British Government and its officials to ensure continuity of funding. This, together with uncertainty about future funding for Employment Training following the creation of the new network of local, employer-led Training and Enterprise Councils, was widely perceived as a threat to the future viability of many providers. The number of respondents who express concern about funding suggests that it should be urgently reviewed.

## *Liaison with other organisations*

Training providers ideally provide a bridge to employment and/or further training leading to employment for disabled persons. On the one hand, therefore, they would be expected to link up with various organisations such as health and social services or voluntary bodies which seek to encourage disabled people to enter training. On the other hand, they would be expected

to link up with employers and other services which specialise in assisting disabled people into employment either immediately after training or following additional education or training.

In this context, and not surprisingly in view of funding arrangements, 30 respondents reported regular contact with the Department of Employment training service administrators or other training organisations. Twenty-one reported regular contacts with local authorities, mainly social service departments. Other referral sources are indicated by references to links with voluntary organisations of or for people with disabilities (25 programmes), Department of Employment Disablement Advisory and/or Disablement Resettlement Officer services (19 programmes), National Health Service organisations (11 programmes) and Employment Rehabilitation and ASSET centres, both specialising in vocational assessment of people with disabilities (7 programmes). While Department of Employment services are also available to assist with placement, most providers used their own resources for this purpose. All but two reported that they arranged work experience placements and/or provided other help with job placement. The other service frequently used in this way is the further education college: 16 providers reported close liaison with such colleges. Regular liaison with employers, however, was reported by only 12 training providers, and not one mentioned liaison with trade unions. Other less frequently contacted organisations, mentioned by four respondents or fewer, include the Careers Service, day centres for disabled people, industrial therapy organisations, adult training centres, ITeCs, sheltered employment services, citizens advice bureaux, unemployment benefit offices, and private or voluntary organisations specialising in the placement of disabled people in employment.

Two features of respondents' reported pattern of liaison with other organisations might give cause for continuing concern. One is the apparently low frequency of liaison with employers at a time when the future responsibility for vocational training in Great Britain will lie with new employer-led organisations (the TECs). The other concerns liaison with Department of Employment specialist services for disabled people. Only one-half of all respondents are in regular contact with them. The reasons for this were not investigated in this study, but other research would suggest that a major cause of this lack of liaison may be dissatisfaction with the specialist services.

## Conclusions

This survey has compared and contrasted the aims, resources, programmes and effectiveness of 40 British organisations currently involved in the training of disabled people in NT skills. Although replies were received from 85 per cent of the 47 organisations which were invited to participate in the survey, there is no accurate way of checking the representativeness of this sample. While all well-established training providers are included amongst respondents, some smaller and/or more recently launched programmes may

have been missed. Disabled people who are trained on employers' schemes or on "integrated" national or local training programmes have also been missed. The survey therefore focuses mainly on "segregated" programmes which specialise in the training of disabled people. In this context, the data provided by respondents suggest that such NT training in Great Britain is:

(1) concentrated on information technology-related occupations rather than on any other aspect of NT;

(2) offered in a variety of settings whose primary objectives range from mainly therapeutic to purely vocational;

(3) provided on a segregated rather than an integrated basis, with a mixture of full-time and part-time courses, usually lasting one year and generally leading to formal qualifications;

(4) mostly geared to low-level, office-based, word-processing and data-processing skills (the main exceptions being in computer programming, electronics and computer-aided design and engineering applications);

(5) well subscribed to, with four-fifths of all courses fully occupied; with spare places mostly available on smaller, comparatively new, therapeutically oriented courses, and with waiting lists (of up to a year) for all other courses;

(6) led predominantly by the voluntary sector rather than by the public or private sector;

(7) provided for persons of all ages and with a wide range of disabling conditions – sensory, physical and mental – although persons with mental handicap (retardation) or with cognitive disabilities arising from traumatic brain injury are either less well catered for or not catered for at all;

(8) provided under very demanding circumstances in which trainees' requirements for vocational training have to be met alongside equally pressing requirements for additional help with literacy, numeracy, social and communication skills, and job search skills;

(9) provided for people who are unable to secure similar help within mainstream training provided by employers or colleges and who generally are very appreciative of the training received and the opportunities it opens up for them;

(10) generally successful, with a high proportion of trainees completing training, four-fifths of completers (77 per cent) obtaining qualifications, three-fifths of completers (57 per cent) obtaining employment; and with others moving on to further education or training before commencing employment; and

(11) funded on shoestring budgets from miscellaneous sources which cannot be said to provide a secure foundation for planning, development or long-term viability.

More generally, it is a great tribute to the ingenuity, drive and determination of all concerned that so much apparently effective work has been done in such a comparatively short space of time. It is therefore all the more regrettable that recent changes in national vocational training policy – which will result in a transfer back to employers of responsibility for training – now threatens to undermine some of these accomplishments. To make the proposed changes effective, in the context of a markedly smaller budget for vocational training provision of all kinds, the British Government is intending to reallocate to private sector control much of the funding that previously supported voluntary sector initiatives. As all the full-time programmes included in the survey are substantially dependent on these funds, it follows that they will either have to find new ways of ensuring continuity and stability of funding or face a very uncertain future, even closure. Future effectiveness almost certainly will also depend on training providers establishing closer links with employers and making more effective use of – or, possibly, securing a more effective response from – the various Department of Employment services for disabled persons.

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## Annex

*Survey respondents*

Ad-Tech Employment Institute, Glasgow; Data, Bradford; Disabled Persons Computer Centre, Polytechnic of Central London; East Surrey Resettlement Association, Redhill; Finchale Training College, Durham; Focus, Buckinghamshire College, High Wycombe; Greenbank Project, Liverpool; Ground Floor Centre, Hebden Bridge; Harrow Weald College, Harrow; Hereward College, Coventry; Hobbes Unit, Swindon; Lambeth Accord, London; Learning and Enterprise Opportunities, Chester-Le-Street; Management Centre, North Staffs Polytechnic, Stafford; Many Hands, London; Monkmoor Centre, Shrewsbury; Neath Hill Workshop, Milton Keynes; Newlink, Nottingham; Outset, London; Portland Training College, Mansfield; Portugal Prints, London; Queen Elizabeth Training College, Leatherhead; Rathbone Society, Manchester; Reading ITeC, Reading; RNIB Royal National College, Hereford; RNIB Vocational Training College, Loughborough; RNID Court Grange, Newton Abbot; Scottish Association for Mental Health, Edinburgh; Share Community, London; Slough ITeC, Slough; Speedwell Information Technology Centre, London; St. Bernard's Hospital, Southall; St. James House, London; St. Loyes Training College, Exeter; St. Mary Abbot Rehabilitation and Training, London; Suffolk Employment Training, Ipswich; THATT, London; West London Asset Centre, Middlesex; Wolverhampton Polytechnic, Wolverhampton; Worklink, Huddersfield.

# 4

# The effect of new technology on the employment of blind and visually impaired persons in four Western European countries

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The effect of new technology (NT) on the employment of blind and visually impaired individuals in any country cannot be analysed adequately without taking into consideration the influence of a number of other factors. The analysis should be conducted within the context of the employment history of blind people in the country. Public policies should be studied, especially those affecting the lives of disabled people, such as their education, employment, social security and pensions and the programmes or procedures used to pay for needed adaptive technology.

Societal attitudes toward disabled people are also obviously important, but methods to judge their effects are far more subjective than those used to investigate policies. Their perceived influence is reported here through the comments of people interviewed for this study.

This chapter is based on interviews conducted by the author in four countries: Austria, Denmark, France and Germany. Twenty-three sites were visited, including educational training facilities, vocational training programmes, universities, technical schools, employment settings, and organisations of blind people. Space will not permit detailed descriptions of programmes studied, but brief overviews are provided to support observations, perceptions and conclusions. The following sections consist of six key observations and discussions of their relevance to the effects of NT on the employment of blind and visually impaired people in the countries studied.

## The effect of NT on traditional employment

Our first observation is that NT has affected traditional employment. For many decades, blind people in most countries have been steered into a limited number of traditional employment areas. The four countries studied here follow the patterns common to most other Western European and North

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American countries. Earlier in this century, blind people, most of whom had a limited education, were trained to weave baskets, make brooms or tune pianos. In the late 1920s, Germany began employing blind people as metal workers, primarily as assemblers. Still later, after the Second World War, more employment options began to emerge. The three most common jobs then opened to blind people were the operation of telephone switchboards, typing from dictation, and physiotherapy (normally limited to massage and therapeutic baths). Again, as with the earlier traditional employment positions, limited education was needed to enter the job training programme.

In most of the traditional jobs mentioned, automation stemming from the evolution of technology (as observed in so many other fields) affected the methods of performing tasks and thus the lives of blind employees. The metal assembly work in Germany was one of the first of these jobs to be affected by automation. Switchboard operation and typing from dictation are other prime examples of jobs which have been affected, and have evolved dramatically, through the intervention of NT.

Multiple-line switchboards of the 1950s and 1960s were generally operated with the aid of technology, most commonly in the form of tactile light indicators. During the 1970s and 1980s, as telecommunication equipment became more sophisticated, switchboard operators (often called telephonists in Europe) were required to monitor more information that was normally displayed digitally. Blind telephonists were similarly equipped with specially designed and fabricated equipment containing Braille displays that tactually presented information concerning numbers called, telephone lines in use, time of calls, and the like.

The activities of those who type from dictation, commonly called "phonotypists" in Europe, have also had to evolve in response to the challenges of NT. First, the mastery of newly introduced dictation equipment often meant new training. Second, the introduction of dedicated word-processing machines often presented serious barriers to blind typists until accessible microcomputers entered the market-place in the 1980s. In some situations, this latter technology has also had a negative effect on their employment because fewer clerical personnel have been needed in many job sites.

At present, the employment of blind people as telephonists or phonotypists is characterised by a broad concern for ensuring that adaptive technology keeps pace with changing office technology, so that blind people, especially those lacking an extensive education, can continue to work in these fields.

In France, a concern that other telecommunication technology is making the switchboard unnecessary is widely expressed. This concern is heightened by the knowledge that switchboard operation employs 1,400 blind people, more than any other job in the country. In the past few years, 200 telephonists have been trained but remain unemployed, in part because of the effects of automation.

In Austria, both telephonists and phototypists are beginning to use microcomputers. These people are mainly those already employed in these

positions and who are receiving additional training at the direction of the employers. Telephonists are using the computers to locate telephone numbers quickly, or make better referrals, by interrogating a computerised file. Without this added technology, they would not have been able to keep their jobs with large agencies or firms. Similarly, blind phonotypists are now being trained in word processing along with their sighted peers. The training is generally carried out within the agency or company, although some blind persons receive this training at a special institute for blind people.

The formal curriculum at the Austrian Institute for the Blind for training telephonists is under review, with plans to revise it to include training with other office equipment, in response to the demands of the job market brought about by automation. Modern telephone terminals require data transfer, the use of fax equipment, and the ability to access data files needed to route telephone calls correctly. The proposed curriculum changes also acknowledge the need for new telephonists to possess social as well as technical competence. Austrian telephonists will be trained with new Braille displays for the telephone terminals.

Austria will continue to train telephonists and phonotypists because of its high success in the past. Almost all students finishing these vocational training programmes have jobs within one year. With this success, there is no serious push for new programmes.

In Denmark, the switchboard position is evolving to include more administrative duties, and so appropriate technology is now included in the training programmes for blind people, many of whom are employed as switchboard operators for the Danish customs office, a large agency. They will soon have both speech and Braille displays for their telecommunication equipment. This will be the first combination of Braille and speech provided for governmental workers in Denmark (Braille is considered preferable for displaying names, addresses and telephone numbers).

Many phonotypists in Germany work for the Ministry of Justice. Both vocational trainers and blind advocates expressed serious concern regarding the future of this opportunity owing to the pressures of automation and innovative technology. At present, however, the demand for well-trained phonotypists remains, and placements continue.

In summary, it is clear that the effects of technology upon the traditional employment opportunities for blind people in Western Europe have been mixed. First, jobs have continually been threatened by the evolution of the technology used by other workers in the labour force. These employment areas have been kept viable for blind people only through the adaptation of existing technology, or the introduction of specialised products. The most serious concern appears to relate to the population most directly affected, i.e. the less educated blind people. As will be discussed in subsequent sections of this chapter, well-educated blind people have numerous additional employment options. The vast majority of blind people, however, do not receive formal education beyond the age of 14, and their vocational training is normally limited to a single activity. If these individuals are to continue to have viable

employment opportunities, these additional job categories must be kept open to them, or new options must be developed.

## Employment opportunities generated by NT

Our second observation is that employment opportunities have in fact been opened up by NT.

For a number of years, many blind people in Western Europe have been employed in a diversity of jobs other than those considered traditional. Most of these persons have apparently shared two traits. First, most have benefited from higher levels of education than those employed in traditional positions; and second, they appear to have been more assertive. In Germany, for several decades, well-educated blind people have often studied law and have been employed as attorneys in local and regional governmental service. In both Austria and Denmark, numerous blind people have been trained as organists and have been employed by churches as musicians and even as music directors.

NT is beginning to have a positive effect on these two employment categories as access to information is being facilitated by microcomputers. Perhaps more importantly, NT is helping to develop additional job opportunities for blind people. Again, the best-educated blind persons appear to benefit most.

The Fondation pour la réadaption des déficients visuels (FRDV) in Paris conducted a survey of several thousand blind people to obtain information concerning jobs currently held by blind people in France. Approximately 100 different job categories were identified. Most people worked in traditional occupations, but the remainder were spread throughout the nation's economy. Among the jobs listed were: teachers, lawyers, translators, interpreters, governmental administrators; and a number of jobs requiring the use of a computer (word processing, systems engineering, programming and systems analysis). The Optacon (a reading system imported from the United States) is used in translating and in governmental positions. FRDV staff estimate that as many as 200 blind workers in France may have computer skills, and use both Braille and synthetic speech displays. A steady move toward computer-related positions has been noted by FRDV, a move that reflects current labour market demands and the availability of appropriate adaptive technology. Telemarketing is another option currently under review in France as a vocational option for blind people, because both computers and telecommunication equipment can be made accessible.

A similar trend toward the use of NT in employment was observed in Austria. The Government is beginning to develop the use of the computer in its offices, and new job opportunities for blind people are expected to result. Already, a number of blind people are working in banking and insurance firms, where computer literacy is a prerequisite. Thus, it was essential to make this technology accessible. These workers, like most other blind computer users in

Austria, use Braille displays. (According to those interviewed for this study, it is only recently that a speech synthesiser with acceptable German pronunciation has become available.) In most cases, these people have received their technological training on the job, as have their sighted peers.

Governmental offices in Denmark are also making much greater use of automation and office computers. Some blind people have been employed in these offices in positions that require regular use of computers. Both Braille and speech displays are used in Denmark. The Institute for the Blind and Visually Impaired (Instituttet for Blinde og Svagsynede) regularly receives requests from employers and blind workers for guidance in selecting the most appropriate technology. Institute personnel also provide training when it is needed. As a relative indicator of the rate at which blind people in Denmark are beginning to use computers for educational and employment activities, the staff at the Institute provided data concerning the number of requests for technical assistance received over the previous four years. In 1986 they received three requests for technical assistance regarding NT selection and training; in 1987 the number of requests rose to 13; in 1988, to 26; in 1989, to 41; and in the first three months of 1990, 15 requests were received.

In Germany, computer science as a potential career is beginning to grow in popularity among blind students in higher education, although the number currently studying this subject is still very low. Of the 110 blind students at the Philipps-Universität Marburg, 30 are studying law. That number is considered low in comparison with the proportion in years past. The change is seen as an indication of the growing number of career options. For example, 20 Marburg students are studying economics. This is a new trend, one that parallels the trend for all students. For sighted students, economics can lead to careers in both corporate and public administration. However, almost all blind economics graduates will move to the public sector because the Government provides disabled employees with the necessary helpers and technology and because private employers continue to be reluctant to hire blind people.

This review of new employment options supports the view held by those interviewed for this study, who repeatedly stated that blind people with the highest education, with previous experience or with other qualifications have much better prospects of obtaining competitive employment. Demographic data, however, do not offer significant encouragement for the vast majority of blind people in these four countries. Recent educational trends may change this view in a few more years.

The most complete data are for the former Federal Republic of Germany, but they appear to be consistent with the more fragmentary data obtained for the other countries. Among the population of the former Federal Republic as a whole, only 20 per cent completed all the years of schooling and the examinations required for university entry. Only 5 per cent of blind people reached this point in their education. Even then, 14 per cent of employed blind people were in a professional position. (The apparent discrepancy is due in part to the large number of blind people who develop a visual impairment after

they are already employed. This fact also testifies to efforts to retain these persons in the labour force. New technology and job retention will be discussed later.)

Until recently in Austria, blind children usually finished their education at the age of 15 with minimal vocational training beyond chair-weaving. In the mid-1980s, Austria began to encourage "mainstreaming", the education of blind children in regular classrooms. Mainstreaming begins at the age of 10 and has led to a greater interest in the possibility of higher education. Previously, such considerations were not encouraged by the Government and could only be achieved through private efforts.

In 1980, Denmark enacted landmark legislation intended to integrate disabled people into all aspects of society. This legislation has had a significant impact on the education and employment of blind people, not all of which has been positive. The effect of the legislation was to transfer primary responsibility for educational, social and economic services to the local community, many of which are small and have limited human or fiscal resources. Thus, the Institute for the Blind and Visually Impaired provides many kinds of support services to communities throughout the country. For instance, it provides a yearly orientation course for blind students from other communities, Braille and recorded materials for teachers, and other educational and vocational services including technical support, technology training, vocational counselling and placement.

Blind people, along with all other Danish students, can now choose to enter any of the many technical schools. The school can then ask for assistance from Denmark's Ministry of Education or Ministry of Social Affairs. This assistance can take several forms, including expert consultation or funds for technology. In the spring of 1990, 90 blind people in Denmark were in formal vocational training: 20 at the Institute for the Blind and Visually Impaired and the remaining 70 in regular technical training schools. The Skive Trade School is one of the technical schools that offers a computer programming curriculum. About seven blind computer programmers are now employed in Denmark. Unfortunately for all students who have recently completed this training, the demand for new programmers is minimal. Since June 1989, 80 students who completed the course remain unemployed.

One atypical example will demonstrate the extremes to which the Danish authorities have been willing to go to implement the intent of the integration legislation. A blind man chose to attend a technical school and to study to become a motor vehicle mechanic. The school asked for assistance from the Ministry of Education, which in turn assigned a consultant. A team was constituted to address the needs of the blind student. The team consisted of the consultant, professional training staff, the manufacturers of commercial instruments used by motor vehicle mechanics, developers of adaptive equipment, and the blind student. About 1 million Danish kroner (about US$150,000) was spent on the development and construction of specialised equipment used in training and intended for subsequent use in employment. The Ministry of Education paid for the equipment. Unfortunately, three

problems (reading diagrams, adjusting light beams, and discriminating among coloured wires) were not resolved, and the individual is now employed as a machinist.

The expanding job opportunities being created by NT can be effective only as long as adequate training programmes are in place. The following section will describe programmes that are currently providing blind people in each of these four countries with the training needed to master new technology and to use it productively.

## Insufficiency of NT training methods

Our third observation is that effective mechanisms for training blind people to use NT for employment have been established in Western Europe, but that they are insufficient to meet a growing demand for technology training.

Each of the four countries examined here have introduced effective NT training programmes, in both the private and the public sectors. They are located within both traditionally disability-related facilities and those operated for the non-disabled population. Four different models of providing technology training were observed, and each appeared to supply the desired training. The chief problem is that there are too few trainers when compared with the growing demand for these services. The following paragraphs will briefly describe the four training models.

### *Private contractors*

In each country there are both individuals and organisations providing blind people with training in the use of microcomputers and adaptive technology on a contractual basis. Business and industry, schools and governmental agencies regularly use these training services to ensure that employees, students or clients attain the necessary level of proficiency. The contractual approach is considered cost effective because it is less expensive for the governmental agency that is normally paying for the adaptive technology and for the training, and it meets the needs of the company.

In France, FRDV has been providing training in the use of adaptive technology since 1974. This was originally directed to tape recorders and the Optacon, later moving to the VersaBraille and computers.

In Austria, the staff of the Technische Universität (the Technical University) in Vienna provides technical assistance and personal training to businesses and governmental agencies. The staff begins with a needs assessment and recommendation regarding the technology needed to perform a task. The subsequent training relates directly to the use of the equipment for the company's needs.

The Institute for the Blind and Visually Impaired in Copenhagen has a Department of Aids and Appliances that provides not only NT training but also technical assistance and training to non-students in universities and in employment on a contractual basis. This training begins within the Institute for three days of evaluation and a week of training in word processing and specific application programmes needed in the employment setting. Once the actual equipment is in place, on-site training continues for a few hours. Follow-up services are provided on request, primarily by telephone. The Institute's computer training programme began in 1986, but was originally limited to educational training. Soon, however, its value was seen for promoting job retention of blind employees and for university students. The external technology training has become a significant part of its activities in the past two years.

The German association of blind students and professionals contains a "blind computer users group" that provides training in the use of computers and adaptive technology to blind students at the University in Marburg. The University has had an active Office of Student Support Services for blind students for the past four years, located within the disabled student centre. Staff say that blind students have two major problems: getting reading material in a form which can be read, and obtaining access to computers. This training is now offered to those who request it, and it is paid for by the regional Government for Hesse. The Government pays the Office a negotiated amount annually for each student served. Having blind people act as trainers is also considered a psychological benefit for the students.

## *School-based technology training*

In Germany, the study of computer science and information technology is becoming a regular part of standard primary and middle school curricula. This subject is now being introduced into the schools for the blind. This will mean that blind students will be introduced to microcomputers and adaptive technology at an early age.

All schools in Austria for children above the age of 10 are now receiving computers for the teaching of informatics. The Institute for the Blind in Vienna is also receiving its computers, but the adaptive technology will arrive later. This Institute has long offered some vocational training for students between the ages of 10 and 14. In the past, such training was limited to traditional occupations. Now the school is proposing to upgrade its phonotypists training to include computer-based skills. This training will include word processing, accounting software and some optional computer programming. Students will receive one year of technical lessons followed by two years of practical experience. In order to make these curricular changes, the Institute must obtain approval from the Ministry of Education because it must provide for the needed staffing and equipment. Immediate approval is not guaranteed.

If these changes are approved, long-range plans call for the addition of a computer programming curriculum.

## *Mainstream training*

FRDV in France estimates that approximately 100 blind people employed in computer-related positions in France were trained in either universities or other mainstream training organisations.

The Skive Trade School in Denmark has trained blind students in a mainstream environment. Students, using a Danish speech system and screen reading program, have studied PASCAL, COBOL, ASSEMBLER and Word-Perfect.

## *Institutional training*

Each country has institutions providing disabled people with specialised NT services. In Germany, most are traditional rehabilitation centres. Denmark, however, has a unique centre dedicated solely to providing NT for disabled persons. The Danish Centre for Disabled Persons (DATCH) is mainly engaged in collecting, assimilating and preparing information on NT for broad distribution to disabled people, service providers and employers. DATCH, however, does assess disabled persons for the purpose of providing consultation on the appropriate selection of technology. This involves a significant amount of training of disabled people, including blind persons, in the use of the technology.

The Government of Austria's social security agency (Allgemeine Unfallversicherungsanstalt) supports a privately operated computer training programme at Linz for persons who have had to leave employment because of injury or disease. This programme aims at enabling such people to return to gainful employment. The Deputy Director-General of the agency said that disabled people want to work, and giving them this opportunity is cost effective because they remain taxpayers rather than recipients of public funds. The programme at Linz has two technology training projects dedicated to meeting the needs of people with visual impairments.

Germany has a number of public and private vocational rehabilitation centres, most of which now provide some vocational training that requires use of NT. The rehabilitation centre in Marburg has as its primary mission the training of newly blinded individuals. It does, however, provide technology training for blind workers who must upgrade their skills. Special attention has been given to blind secretaries who need to master computer skills.

The Süddeutsches Rehabilitationswerk für Erwachsene Blinde (the rehabilitation centre in Veitshocheim) has an extensive programme to promote job retention for blind, and newly blinded, workers who must master computer technology for their tasks. These workers are brought to the centre

for an average of four weeks of intensive technology training. This centre also has long-term vocational training programmes in a number of non-technology-related occupations. One programme that has made technological changes to enable visually impaired individuals to compete is in the centre's industrial workshop. Students are trained as metalworkers, and taught to use numerically controlled machine tools for computer-aided design. The instruments are equipped with large-character displays for visually impaired students. Blind students are not taught in this programme because at present it is not possible for them to read technical drawings or the graphics necessary for setting the machines. Nevertheless, NT is opening up computer-aided design to partially sighted individuals.

The programme and philosophy of the Berufsförderungswerk Stiftung Rehabilitation deserves especial attention. This is a private vocational training centre for disabled people in Heidelberg. It is limited to adults. The name means "professionals promotion institution". The institution is operated as a business and receives its training fund as fees from the Government. It has an extensive computer training programme for 1,800 disabled people, including dozens who are visually impaired or blind.

To enrol in this institution, blind students must be able to read and write Braille, either have or develop good independent mobility skills, and have mastered the standard typewriter keyboard. The institution teaches software applications, accounting, bookkeeping and several programming languages. The curriculum, which lasts two years, also includes English, mathematics, data processing and organisational skills. Blind students use either the Optacon or Braille-line display to access the computers.

Placement in competitive employment is a concerted action on the part of the institution that brings together several disciplines. An adviser for data processing works with employers to find jobs for newly trained people. When a person is first employed, the Ministry of Labour and Social Affairs will pay up to two-thirds of the salary for six to ten months. About 85 per cent of the trainees obtain competitive employment within four to six weeks of completing the training, although some may take up to a year before being placed.

The institution offers a third year of advanced computer training that is open to partially sighted but not blind students. The third-year curriculum requires specialised materials that cannot at present be provided in Braille. Partially sighted students, however, each have a closed-circuit television at their worksite which can display material directly from the trainer as well as being used for personal assignments and for study.

Future plans call for the institution to move into telecommunication training. This curriculum will also be closed to blind students as a result of the perceived trends in computer design, namely the emphasis on graphically presented materials. Officials at the Heidelberg institution fear that, within six years, blind people will not have access to either new computers or software. So far the institution has placed about 290 visually impaired students and about 80 blind students in competitive employment as computer programmers, about 60 per cent of whom are in the private sector.

An advantage that private institutions have over public ones is the ability to respond rapidly to new demands and opportunities. Public facilities are normally burdened by the paperwork and review processes common to most bureaucracies. The efforts to modify the curriculum at the Institute for the Blind in Vienna were reported earlier, but similar experiences were encountered in other places. In France, it may take more than two years to initiate new training programmes in public institutions. After the new topic is identified, the curriculum must be developed and reviewed, and then funds must be found to pay for equipment and new staff. New staff positions also must be justified to the parent ministry or agency because a maximum number of personnel can be employed throughout the larger organisation. The acquisition of additional slots requires reductions in some other area or institution. The hope is that the new curriculum will still be valid when training eventually begins. Several years were needed to convince authorities in France that computer training for disabled people had value. In addition, in small countries such as Austria and Denmark, the number of blind and partially sighted people seeking employment is small. Thus, there is resistance to securing funds for new curricula.

An advantage enjoyed by all four training models observed in Western Europe relates to the array of public funds that can be secured to pay for both the training and the technology. (The Heidelberg institution even received public funds to build and equip residential facilities for students with severe motor impairments.) In each country, however, service providers and administrators agreed that funds were inadequate to provide the trained staff and the equipment necessary to meet an increasing demand for vocational and technology training for blind and visually impaired people. The following section will review policy and payment issues pertaining to the acquisition of training, technology and employment opportunities by people with disabilities in these four countries.

## The effect of public policies

Our fourth observation is that public policies promote economic independence for disabled persons, but that unemployment within this population is high.

Public policies in the four Western European countries under study are working to promote full participation in society by disabled people. These include policies that promote employment, payment for vocational and educational training and adaptive technology, and personal financial benefits. This section emphasises the three types of public policies that promote employment: employment quota laws; public subsidies of salaries; and reimbursements for training, adaptive technology and environmental modifications.

France, Austria and Germany have employment quota laws. Denmark does not, but its Minister of Social Affairs has called for one. (The disability community, through a federation of consumer advocacy organisations, is

opposing the suggestion, saying that disabled people want to be employed on merit, not by decree.) Each of these three quota laws requires all organisations employing more than 16, 20 or 25 workers to employ a prescribed proportion of disabled people. If the organisations do not conform, they must comply with an alternative. In Germany and Austria the alternative is a fine. In France four alternatives are offered, but organisations regularly choose to pay a monthly fee rather than comply. Unfortunately, the situation in both Austria and Germany is similar.

In Austria, the funds accruing from these penalties are to be used by the Government to promote the productivity of disabled people. Options include payment for adaptive technology, education and training, reimbursement for a company where employment of a disabled person did not work out (a salary subsidy), or payment for sheltered workshops. If a company employs more disabled workers than legally mandated, some funds may be returned. The Austrian law, passed in 1967, also makes it virtually impossible to terminate a disabled employee. This rule is widely considered to be a hindrance to promoting employment in the private sector.

In Germany, penalties from the quota system are used to pay for adaptive technology and for services including training. They can also be used to subsidise the initial salary of a new disabled employee.

In France the quota system began in 1987. In its first three years 360 million francs were paid in lieu of employing disabled workers. These funds, controlled by the new agency AGEPHIP, are to be spent on public education or on the development of adaptive equipment and materials for disabled people. To date no plans have been made for the use of these funds. Critics of the French quota system point out that there are no statistics on the number of disabled people in France, and it is therefore impossible to know if there are enough potential disabled workers to permit companies to attain their 1992 quota of 6 per cent of disabled employees.

Other policies in these countries promote the employment of disabled workers. In France, employers can have up to 80 per cent of the purchase price of adaptive technology reimbursed. Public retirement insurance funds in Austria can be used by insurance companies to pay for adaptive technology because they want to avoid long-term disability payments. In Denmark, the Ministry of Social Affairs provides an inducement to companies to employ disabled workers, in the form of salary subsidies. For the first few months trial employment is performed under a contract paid for by the Ministry, and an extended period of employment may have 40 per cent of the salary subsidised.

A policy common to each country relating to the provision of adaptive technology by governmental agencies deserves special comment. The potential user of the technology plays a significant role in its selection. The individual is usually required to provide a written justification for the technology. The inclusion of disabled people in the decision-making process is laudable, but this requirement often generates unfortunate obstacles. First, assertive individuals have an advantage over their less aggressive peers. Strong justifications can be developed, and appeals pursued when necessary. Second, govern-

mental officers assigned to review the applications may know less about the technology than do the applicants. Decisions are still made on the basis of official judgements. One example of a poor judgement that prevented the acquisition of needed technology relates to a legally blind woman who retained sufficient vision to read large-character computer displays. A computer with a large colour monitor was provided. Nevertheless, the official refused the request for a printer, indicating that a blind person would have no use for print-outs of material developed on the computer. No thought was apparently given to the need to communicate with sighted people. Agencies must develop the expertise needed to make decisions concerning adaptive technology.

Despite the progressive policies found in these four countries, unemployment among all disabled people, including blind and visually impaired persons, is reported to be high. Two key reasons relate to societal attitudes and to national economics. Even with increased public education concerning disabled workers, and with a growing number of exemplary disabled role models, the general public is still reluctant to accept disabled people. This factor is compounded by a growing general unemployment rate in these countries. Every job opening receives many applicants. Employers are reluctant to hire a disabled applicant when there are many other qualified alternatives, especially when it may be difficult to terminate the person.

Future employment projections suggest that the situation may not improve in the foreseeable future. Currently, for example, the unemployment rate in Denmark is 10 per cent: the national banking industry has announced a plan for significant reductions in the number of employees over the next decade; and in the private sector, IBM will also be freezing its workforce at the current level.

These are factors which cannot be resolved with new technology alone. They call for a concerted effort by all sectors of the economy. Two interesting partnerships established in France and Denmark are described in the following section as possible models for future consideration if their efforts bear fruit.

## The need for public and private sector partnerships

Our fifth observation is that partnerships are needed between the public and private sectors to expand employment opportunities for disabled persons. Such cooperation may provide a mechanism to promote the employment of disabled people in the private sector. Two current efforts warrant examination and future scrutiny.

The Institute for the Blind and Visually Impaired in Denmark obtained resources from the social fund of the European Economic Community (EEC), which supports special projects to promote the employment of groups of people with special needs. The Danish project is to assess the use of computers in the education and employment of people with visual impairments.

The project is a joint effort between the Institute and the business community. Success will depend on the continued cooperation of private firms. Potential employers have agreed, as an association, to work with the Institute. IBM-Denmark is one of five large firms that are committed to helping to find employment for six students selected for the first phases of the project. Each student received a ten-week training programme in computer applications – word processing, accounting, and other managerial activities. The first six students selected were unemployed but had good employment records before becoming visually impaired. The Institute will provide the firms with an assessment of the job opportunities and the needed adaptive technology, along with other support services.

A second project involves awareness training for industry. This ran into difficulties at first, because business and industry leaders indicated that they were not prejudiced in this regard; now they are agreeing that they do need training.

A worksite survey and job analysis form another part of the joint project. Many new employment categories have been identified in the insurance industry, all requiring the use of NT.

The Institute was required by EEC policies to match the funding with an additional 2.6 million kroner, and has accordingly agreed to continue the project into subsequent years.

The second programme reflecting a partnership between the public and private sectors is in France. GIRPEH (Groupement interprofessionnel régional pour la promotion de l'emploi des handicapés) brings the Government, private sector employers, trade unions and disability groups together on employment issues. Three active working groups are tackling three broad topics: business functions, medical and health issues, and legal issues. GIRPEH offers a series of training programmes for disabled people and for business and industry. It regularly schedules a five-day programme to teach disabled people how to prepare for interviews and how to talk about their disability openly with potential employers. A three-month programme gives instruction in reading and writing to low-functioning disabled people who have been looking for a job for at least a year. The teaching is provided by GIRPEH employees who formerly worked in business. The primary work of GIRPEH, however, is to encourage businesses to employ disabled people, both for entry-level positions and for upward mobility. Materials are written and disseminated, and special programmes are presented.

GIRPEH officers are interested in finding ways to promote NT, but say that there is a lack of credible expertise in France on the application of technology to meet the needs of disabled workers. Only the vendors of technology are known to GIRPEH, but their opinions are suspect to employers.

GIRPEH receives money from the Ministry of Labour, Employment and Vocational Training for the training of disabled people, but the majority of its funds come from dues paid by member firms and organisations. It appears to be the only organisation in France promoting expanded employment opportunities for disabled people, but needs to develop new expertise (regarding NT,

for example) and to establish a close working relationship with AGEPHIP, the organisation that collects the funds from companies that do not comply with the quota legislation. Together, the two organisations could operate a potentially valuable programme of public education, individual training and technology dissemination.

## NT and the role of blind persons

Our sixth and last observation is that new adaptive technology in Western Europe is state-of-the-art, and blind people have an active role in working with developers.

During this study, the technology used in each training centre and worksite, and in the homes of blind individuals, was examined. In each country it was found that computer, telecommunication, measurement and adaptive technologies were state-of-the-art. Many systems are imported from Sweden and the United States, and a few from the Netherlands and the United Kingdom. A number of quality products have also been designed, produced and distributed within each of the four countries studied: in each case, blind people played a significant role in their conceptualisation, design and evaluation, and they continue to propose modifications as necessary.

One example of a responsive developer concerns a computer screen reading programme used by blind computer users. Several users have reported that the developer is always accessible for comments. Suggestions for changes are almost always incorporated in an updated version of the software within a few days.

In Austria, an informal organisation (ARTEC) examines the technological needs of disabled people. The group meets about five times a year to exchange information and discusses the needs of a different disability group each time. ARTEC includes representatives from industry, disability advocacy groups and the world of education, as well as other interested persons.

Blind computer users appear to prefer Braille displays to synthetic speech, although speech is more widely used now that improved synthetisers with better pronunciation are available. Many visually impaired individuals, however, cannot use Braille, so speech can supplement large-character displays.

Two institutions (one in Skive, Denmark; the other in Munich, Germany (operated by the Bavarian Association of the Blind)) use NT to produce Braille material for blind readers. Both receive most of their requests from employed blind people who need work-related material in Braille, such as laws, regulations, telephone and inventory lists and computer manuals. Both institutions use an optical scanner for data entry, and a computer, Braille translation software and high-speed Braille printers to convert the printed text into Braille.

A serious problem facing both these institutions relates to occasional objections raised by copyright holders. The institutions would like to store

printed material that has already been scanned on computer disks, thus eliminating the need to re-scan the material at a later date. Some publishers consider disk storage to be a potential danger. This problem will need to be resolved, as more blind computer users can be expected to seek this material on computer disk. These modern Braille production institutions represent another example of NT support for the employment of blind people.

## Summary and recommendations

In this chapter, six key observations relating to the effects of new technology on the employment of blind and visually impaired people in Denmark, Austria, France, and Germany have been presented and discussed. These observations will be restated here, and recommendations for action made.

*Observation 1.* New technology has affected traditional employment.

*Recommendation 1.* Managers of vocational training programmes emphasise both traditional occupations (such as telephonist, phonotypist, and assembler) and new employment trends that may become traditional options in due course including computer programming. Therefore they must monitor labour market trends and the state-of-the-art technology used in these occupations. This will help to ensure that training programmes are appropriate for the jobs available. Research and development should be directed to making commercial technology accessible and functionally appropriate for blind and visually impaired users before endeavouring to design and produce specialised products for these people.

*Observation 2.* Employment opportunities have been generated by new technology.

*Recommendation 2.* Vocational trainers must continue to assess labour market trends, and to link current training and new curriculum development to these trends and to the state-of-the-art commercial technology used in the associated occupations. This assessment is essential if the employment opportunities generated by NT are to be maintained. Research and development activities on new adaptive technology should be initiated only when it is the most cost-effective way to open new employment opportunities for blind and visually impaired persons.

*Observation 3.* Effective mechanisms for training blind people to use NT for employment have been established in Western Europe, but they are insufficient to meet a growing demand for technology training.

*Recommendation 3.1.* The training of employed blind and visually impaired people who need to use NT should be conducted under contract with skilled trainers. This approach has proved to be more successful and cost effec-

tive for employers and for the sponsoring governmental agencies than enrolling the individuals in a specialised training facility that can handle only a small number of trainees at a time.

*Recommendation 3.2.* Many more technology trainers should be recruited from the ranks of blind NT users. Such people have already shown themselves to be especially effective in this role, and should be encouraged to develop the necessary technical and personal skills. The demand for such expertise, combined with the unemployment rate among blind people, makes this option especially attractive.

*Recommendation 3.3.* Specialised employment training programmes for blind and visually impaired people should extend expertise and guidance services to "mainstream" training facilities so that these programmes can help to meet the training needs of blind and visually impaired students.

*Recommendation 3.4.* Educators and rehabilitation professionals must develop mechanisms which will encourage blind and visually impaired persons to obtain the highest possible level of education and training. Business and industry want to employ the best-educated applicants, and experience shows that the most educated blind and visually impaired people are most likely to enter competitive employment.

*Observation 4.* Public policies promote economic independence for disabled persons, but unemployment within this population is high.

*Recommendation 4.1.* Quota laws should be revised so that they will encourage private-sector employers to conform with the intent of the legislation, namely by employing disabled workers rather than paying penalties. Revisions should also eliminate hindrances to employment, such as the inability to terminate unsatisfactory workers.

*Recommendation 4.2.* France should use the funds generated from non-compliance with the quota legislation for the purposes for which they are intended, as in other European countries. Programmes should be developed by AGEPHIP to use the funds to reimburse vocational training and the distribution of adaptive technology and to increase public awareness and understanding of individual disabilities and capabilities.

*Recommendation 4.3.* The implementation of governmental policies concerning the purchase of adaptive technology for blind and visually impaired people should be revised to limit the bureaucratic entanglements that often obstruct the selection and provision of needed technology. Agencies must develop their own technology expertise, or identify and contract for external expertise.

*Observation 5.* Partnerships are needed between the public and private sectors to expand employment opportunities for disabled persons.

*Recommendation 5.* Public and private programmes that specialise in the training of blind and visually impaired workers should establish cooperative programmes with business and industry to facilitate job development and the employment of their clients in new areas.

*Observation 6.* New adaptive technology in Western Europe is state-of-the-art, and blind people have an active role in working with developers.

*Recommendation 6.* Research and development should seek viable solutions to the problem confronting blind computer users who need to access graphically presented alpha-numeric information. Solutions other than the development of a tactile analogue to the visual screen are needed, because neither the tactile nor the auditory senses are as capable of parallel processing of information as is vision. Artificial intelligence should be used when necessary. The key may be to develop a mechanism which will ensure that the basic information displayed on the screen is also accessible to an external system that can present the information in a sequential form. Future technology must ensure the continued importance and value of today's new technology.

# 5

# Factors associated with the traditional rehabilitation centre's ability to train disabled persons for advanced technology occupations

*Michael J. Leahy*[1] *and Robert Leneway*[2]

Rehabilitation facilities represent an indispensable resource in modern vocational rehabilitation.[3] They have generally provided the means for evaluating, treating and training severely disabled persons who otherwise may not have been effectively served. Their development and growth in the United States has varied greatly, depending on the date of the facility's inception, the programme models followed, and the philosophy espoused (Nelson, 1971).

From the early 1970s onwards, rehabilitation facilities seem to have progressed through a distinct developmental phase, characterised by a general shift from in-house training and employment (e.g. sheltered work) to a focus on community-based training, placement and community integration. These characteristics have been translated by some facilities into effective supported employment programmes or into specialised vocational services leading to competitive employment outcomes. In addition, partnerships between rehabilitation facilities and the business community have generated Projects With Industry (PWI) models to develop, implement and maintain new vocational training and placement programmes for disabled people. With the advent of these new external relationships, increased competition among service providers, a shortage of resources, and the ever-changing nature of work, facilities have been challenged to adopt more sophisticated management, human resources and strategic planning capacities.

Today, rehabilitation facilities range in size from large comprehensive centres serving individuals with a wide variety of disabling conditions and offering any number of services, to small, privately owned workshops that serve only a distinct disability group and provide only minimal services

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(Matkin, 1982). There are approximately 5,500 rehabilitation facilities in the United States (McAlees, 1990), serving an estimated 800,000 clients per day and 1.6 million individuals annually (Menz, 1987). Czerlinsky and Gilbertson (1985) found that, of those persons served in facilities, 55 per cent were people with limited intellectual capacity, 21 per cent had problems related to emotional and mental functioning, and 16 per cent had physical impairments. In comparison with the national population of disabled persons, those served in facilities tend to be more severely disabled and more likely to have multiple disabilities, and to require more specific services (McAlees, 1990).

The varying organisational structure, size and scope of the facilities may have an impact on the quality of services offered and the facility's potential to develop new programmes. Feinburg and McFarlane (1979) have pointed out that staffing in facilities can range from one or two professionals and several helpers or paraprofessionals to multidisciplinary teams including numerous specialists from various professions. These smaller organisations frequently require the practitioner to be a "jack of all trades", while in the larger settings specialisation is possible and roles have become more crystallised (Feinburg and McFarlane, 1979). Finally, irregular funding and, in smaller facilities, limited support for continuing professional development are additional examples of factors that may affect professional practice and the programme development of many rehabilitation facilities.

The most significant elements in facility growth in recent years have arisen through changes in the type of services made available in response to the increasing severity of the disabling conditions served. Other factors such as "deinstitutionalisation", a focus on normalisation and integration in service delivery, legislation, accreditation standards (Commission on Accreditation of Rehabilitation Facilities, 1990), critical studies of workshop methods (Greenleigh Associates, 1975), and criticism of practices in facilities (Baker, Baker and McDaniel, 1975; Conte, 1983; Bellamy et al., 1986) have continued to affect the field and provide a stimulus to upgrade the development of services and employment strategies for a growing consumer population.

Concurrently, dramatic changes in the labour market due to the shift from an industrial to a service economy, together with the real and anticipated impact of new technology (NT) on occupational change, have challenged rehabilitation facilities to respond to emerging market demands that potentially represent new opportunities for disabled persons. Vandergoot (1989), reacting to these issues, has called for rehabilitation programmes to become more market driven. As Cornes (1987) has indicated, however, while rehabilitation specialists have generally been optimistic about the impact of technology on the creation of high-tech-based jobs (e.g. fewer physical requirements and more home-based work), such optimism must be tempered by the recognition that disabled people may lack the necessary education and training to qualify for high-tech careers. To date, little is known about how traditional rehabilitation centres are adapting their vocational training and placement programmes to take advantage of NT. According to Bowe (1987), while NT may be making the placement of disabled people easier in theory, little is happening in practice

because many rehabilitation professionals continue to believe that technology is something they don't need to understand.

This chapter provides the principal findings of a study designed to explore the ability of the traditional rehabilitation centre to train disabled persons for advanced technology occupations. The focus is on the identification of critical factors in the development of NT training programmes, how these programmes have collaborated with the business sector, and their subsequent effect on the disabled consumer, the private business sector, and the rehabilitation centre as a whole. The cases studied suggest that there are some key factors shared by organisations which are successful in preparing and placing disabled persons into high-tech employment in the United States. These factors will be identified and policy implications for other countries will be considered. While this study is not designed to be an empirical investigation of factors within a representative sample of facilities, it is anticipated that, as an initial exploration within the limitations of an in-depth case study approach, the knowledge gained may have both practical and heuristic applications in the future.

## Methods

### *Participants*

Two rehabilitation centres were selected for an in-depth case study of their experience with NT. Both organisations have been actively involved with technology over the past ten years, and represent facilities which, during that period, have made major commitments to time and resources to develop organisational competency and community viability in NT training areas. The two centres were:

(1) the Crossroads Rehabilitation Center, Inc., a private non-profit comprehensive rehabilitation centre in Indianapolis, Indiana; and

(2) the State Technical Institute and Rehabilitation Center (STIRC), a publicly owned and operated rehabilitation centre in Plainwell, Michigan.

Both centres are accredited by the Commission on Accreditation of Rehabilitation Facilities (CARF).

These centres were selected on the basis of their previous NT experience and because their organisation differed on a number of important matters such as ownership, location and breadth of mission. For example, Crossroads is privately owned, while STIRC is publicly owned and operated: its parent organisation is Michigan Rehabilitation Services, the state rehabilitation agency. Crossroads is situated in a large populated urban area, while STIRC is in a very rural location. Finally, Crossroads is a comprehensive facility offering medical, vocational and pre-school developmental services to

persons with a wide range of disabilities and ages, while STIRC provides vocational training and placement services to adult clients who are sponsored by the public rehabilitation programme, and who display a wide range of disabilities. It was felt that both the similarities and the unique distinctions between these organisations would strengthen the case study as critical aspects of their respective NT programmes are examined.

### *Procedures*

Data were collected mainly through in-depth interviews with administrators, staff and other significant participants (e.g. consumers, employers, Business Advisory Council (BAC) members), visits to the centres, and analyses of records, reports and other descriptive materials. In addition, interviews with former administrators and staff were taped in order to obtain the full story of the centres' involvement with NT.

All our activities focused on identifying how these two centres first became involved with NT, and on examining the planning, implementation and maintenance phases of the projects described. Particular attention was paid to the centres' use of both internal and external resources, and to the effect on each of these programme development efforts. Finally, critical organisational factors were explored in order to identify key programming and support components that appear to be related to effective programmes and which might be adopted by other rehabilitation centres planning to enhance their services through technologically related programmes.

## Results

In order to set the operations of these two centres in their overall context, we give a general description of each organisation, along with a detailed chronology of each centre's involvement with NT programmes.

### *Crossroads Rehabilitation Center*

The mission of the Crossroads Rehabilitation Center is to "provide comprehensive and coordinated rehabilitation programmes to assist disabled men, women and children to increase their independence, promote their personal growth, and enhance their value to the community". It has carried out this mission for the past 54 years.

#### *Services offered*

The Center comprises four major divisions, with approximately 140 staff members and 23 separate departments or programmes that address

the specific needs of the disabled community. These divisions are concerned with:

(1) vocational development (vocational evaluation and community-based assessment, community-based and in-house work adjustment training, vocational skills training, computer programmer training, basic skills instruction and word processor training, supported employment, job placement, sensory aids technology);

(2) work centres (Crossroads Industrial Services, The ReSource);

(3) medical rehabilitation (physical therapy, occupational therapy, speech pathology and audiology, augmentative communication, adaptive equipment programme, driver training, occupational health services); and

(4) the children's developmental programme (early start, preschool, good start, Lekotec).

The Center is a recognised leader in the comprehensive use of technology in its vocational, medical and children's programmes. In 1989 these programmes provided services to 1,819 persons (60 per cent were adults aged 22 and over, 10 per cent were between 16 and 21, and 29 per cent were newborns to 15 years old) representing a wide range of disabilities.

Since its inception in 1936, Crossroads has consistently expanded its services in the light of identified client needs, new innovative rehabilitation strategies and techniques and available resources. Throughout its history it has been both a noted national leader among comprehensive rehabilitation facilities, and a highly visible service provider within the State of Indiana and the Indianapolis community. With this rich historical foundation firmly established by the early 1970s, crossroads began systematically to explore potential programme development alternatives that would take advantage of its existing strengths and capitalise on the opportunities created in the external environment.

### *Organisational and environmental assessment and planning*

Although initial business contacts regarding the potential use of technology at the Center occurred as early as 1974, it took many years of research, assessment and planning before the Center was prepared to move forward. During interviews with both current and previous Center administrators, it appeared that a number of critical internal and external factors contributed to the overall climate within the Center which eventually led to the introduction of NT programmes. These factors served to build a foundation for proactive innovation in this area. Internal factors cited as important included: the organisation's developing philosophy, values and culture; the high community visibility of the Center's board of directors and private sector support; the Center's extensive experience with volunteerism; noted limitations in training programmes for the severely disabled client; and a staff recruitment policy

aimed at building a strong professional staff. A number of external factors were also having an effect on the Center at the same time. They included: innovations in other disciplines such as education, training and medicine through the use of NT; federal mandates to serve the severely disabled, and the civil rights provisions (Sections 501-504) of the Rehabilitation Act of 1973 which affected both the rehabilitation and the business communities; and increased competition among service providers for limited resources and the subsequent need to plan more strategically for the future.

These internal and external factors during the mid-1970s created a critical need for strategic planning which evolved around four basic principles and an aggressive approach to innovation. They included: increasing the knowledge and systematic use of management and leadership principles at the Center itself, and influencing the industry through example; fostering innovation and creativity among staff and programmes, and working on stifling defeatism and rigidity in expectations; raising the level of morale and esteem among the rehabilitation professionals; and lowering attitudinal barriers among professionals, employers and the public in relation to the potential abilities of disabled persons.

The desired outcome was that as Center staff saw themselves as more competent, they would be viewed as more competent, and if they were viewed as more competent, they would draw disabled clients, the business community and other rehabilitation professionals to the Center. By forming coalitions with these groups the Center could then play a more central role in reducing some of the attitudinal barriers that thwarted innovative approaches to rehabilitation. Finally, two other major factors were central to the Center's strategic planning. First, there was a collectively expressed and overriding need to evoke new paradigms in the training and placement of disabled people that would put the highest emphasis on the involvement and participation of the disabled person in his or her own rehabilitation. This factor, although principally emanating from the Center's developing philosophy, was externally validated through federal policy initiatives included in the Vocational Rehabilitation Act of 1973. Second, there was a strongly held belief among key administrators that the Center needed to harness the known and expected technologies for the benefit of the disabled community. These technologies included those which would increase the client's vocational and independent living capacities, and those which the Center could use to upgrade its services.

### *Pursuing technological innovation*

The Center then began intensive investigation into the development of a technological training programme that would prepare severely physically disabled people for jobs that were both in great demand and offered potential career advancement. A series of meetings and site visits were arranged with IBM's Federal Systems Division, which had received a federal PWI grant from the Rehabilitation Services Administration to assist in the design and development of nationwide computer programmer training projects. With IBM's assis-

tance, Crossroads began building a coalition of rehabilitation and private foundation support which culminated in a series of grants to support the development and implementation of a computer programmer training project for persons with severe physical disabilities. However, with the recognised lack of technological expertise among the Center staff of the time, much of the success of this planned programme depended on the Center's ability to attract talented and committed business professionals to provide advice during the planning, implementation and maintenance phases.

*Developing technology partnerships*

Early in 1979, prior to the design and development of the training programme, the Center and representatives from the IBM PWI project began the critical task of putting together an active BAC. Local business executives were invited to join the BAC and to establish a corporate commitment to the project. Following a number of meetings, 25 local business executives, representing the major employers of data processing personnel in the Indianapolis area, together with key staff and administrators from the Center, and other rehabilitation professionals who could contribute to the project, were appointed to the BAC.

After the selection of a dynamic business leader to chair the BAC, and a series of meetings devoted to the mission and services of the entire Center, all BAC members participated in an intensive disability awareness seminar. Committees were then established to plan and design the following projects: student recruitment, evaluation and selection; technology and facilities; curriculum and instruction; placement; public relations and marketing. For the next four or five months the pace and quality of the work which the individual committees produced, along with the overall policy decisions made by the entire BAC, greatly exceeded the Center's expectations. Business members began to pursue the project goals with a real sense of "ownership and contribution" which remained one of the true strengths of this approach. The effect on Center staff was also beyond what was anticipated. Business people working at the Center and interacting with staff and clients, and staff meeting with local business people, stimulated, enriched and changed the environment at Crossroads. There was an overriding sense that all involved were working on something very innovative and important and this sense assisted the BAC and the Center in tackling the many complex issues and problems encountered during the project's development and implementation.

In September 1979, the first class of severely physically disabled clients began the intensive 11-month curriculum in Computer Programmer Training (CPT). During the past 11 years, nearly 100 persons with severe physical disabilities have been successfully trained, and approximately 85 per cent of these trainees have secured and maintained employment as computer programmers in the business community. The BAC has remained highly active throughout this period and has continued to assist in ensuring the relevance of the curriculum and the adequacy of the technology. Beyond this, they

have made countless contributions to the Center as a whole by advising staff on new training directions and assisting the Center in planning for the infusion of technology into other training programmes. Center administrators, looking back at the multifaceted benefits of this programme, identify this effort and its continuation as one of the most important developments to have happened at Crossroads.

### *Related technology innovations and infusion*

Two years after the successful implementation of the CPT project, the Center began exploring additional career training areas in technology that would complement existing resources, build on the strengths of the CPT project design, and offer clients other career options in high-demand future-oriented jobs. Based on market research and consultation with CPT BAC members, the Center secured grants to pursue further innovation in technology-dependent trades. It began a word processing and data entry training programme in 1981, and an information processing (service bureau) programme called the ReSource in 1982. Both programmes were designed using the PWI model that had been so successful in the CPT programme. However, unlike the CPT programme, some major shifts were required over time in order to keep the programmes viable. These adjustments were made possible through the involvement of the BAC, which helped the project to stay informed about technological innovations and current employment needs in this area.

The technological innovations implemented by the Center during 1979, 1981 and 1982 represented a full-scale effort to move it away from the traditional services offered by rehabilitation centres. Following this period of intense programme development, however, the Center reallocated its resources to work on other critical areas of need within the facility (e.g. redesign and revitalisation of the Industrial Services Division). During this time (1983-86) efforts in technological innovation were oriented not towards new programme development but towards infusing technology into existing training programmes and administrative departments of the Center. Also during this time, those programmes developed in the early 1980s were maturing, and their continued success brought additional media and business attention to the Center. This attention served to heighten the organisation's sense of self-efficacy regarding the application of technology within its programmes.

In the years that followed, the Center experienced the infusion of technology in a variety of programme areas. In 1986, for example, simulation technology was used to develop a drivers' training project that serves disabled citizens throughout the State of Indiana, and an orthotics development laboratory was developed in physical therapy for adaptive seating and casting. In 1988, a sensory aids technology centre was developed, along with technological innovations in the design of an augmentative communication programme. Finally, technological learning tools in the children's programme were introduced in the LeKotec and Comp-u-Play support programmes.

*Summary*

Today, some 15 years after the Center began to consider the question of how it could use existing and developing technologies for the benefit of the clients it served, Crossroads is one of the leading rehabilitation centres in the use of technology. It appears that the Center went through four distinct periods of growth in the application of NT:

(1) an organisational assessment and strategic planning stage during the late 1970s;

(2) an intensive and high-energy technology innovation phase where specific training programmes were designed and implemented with the assistance of the business community;

(3) a maturational, strategic planning and technology infusion phase where activity levels were somewhat less than the preceding phase; and

(4) a further innovation and programme development phase.

As a result, Crossroads has been transformed into one of Indiana's most comprehensive institutions for families and individuals seeking technologically assisted solutions to make home and work environments more manageable for disabled people. Long known for its low-tech expertise (e.g. occupational therapy), the Center has also developed the capacity to provide high-tech aids for blind or visually impaired persons. It has also been designated as the Central Indiana IBM Adaptive Technology Center, which provides disabled people with opportunities to purchase computer products and adaptive equipment at a 30-50 per cent saving for rehabilitative, vocational or educational purposes. The most recent development at the Center is that IBM will be providing a comprehensive state-of-the-art computer system to replace current facilities in the computer training programme. Through this relationship, Crossroads will be one of the sites where NT is field tested, bringing the Center into continuous direct contact with the newest technological innovations.

## *State Technical Institute and Rehabilitation Center (STIRC)*

Michigan's State Technical Institute and Rehabilitation Center (STIRC), the second largest comprehensive rehabilitation training centre in the United States, is located on a 52-acre residential campus near the small town of Plainwell. It is owned by the State of Michigan under the State Board of Education and operated by Michigan Rehabilitation Services, the state's public vocational rehabilitation agency.

*Services offered*

Originally founded during the 1930s as the W.K. Kellogg Camp for the Handicapped, its staff of 89 now serves nearly 1,000 disabled persons annually in 17 vocational training and evaluation areas. Severely disabled students are trained for competitive employment in the nation's most technologically advanced vocational areas, such as CAD-CAM, MAPICS computer programming, telecommunications, micro mechanical technology, desk-top publishing, and electronic security systems, as well as in other non-technology areas (e.g. upholstery, wood finishing, custodial, food service). During the past 45 years, STIRC has had only one primary mission : the training and placement of disabled adults. In 1990, for the first time, a new technology accommodation centre was to open, offering accommodation services directly to disabled persons and to employers' organisations. The programme operates in partnership with many private companies. STIRC's annual budget of US$5.7 million is similar to that of Crossroads, but comes from distinctly different sources. For example, 78 per cent of the funds are from the federal vocational rehabilitation programme, 17 per cent from the State of Michigan, and the rest from grants and private sources.

During its first 30 years of existence, STIRC was a very traditional organisation, offering standard vocational evaluation and training programmes for mild to moderately physically disabled adult males : for example, during the 1960s, physically demanding training programmes were added for such occupations as floor covering, printing and motor vehicle mechanics. In 1971, the Institute became co-educational, creating the need to offer new programmes. In addition, the Vocational Rehabilitation Act of 1973 further emphasised the need to provide services to severely disabled persons. None the less, proposed service delivery changes to face up to these new developments met with some resistance. It was in this climate of change in 1977 that a representative from IBM was invited by state vocational rehabilitation officials to visit STIRC. This official was representing the Federal Systems Division at IBM which had developed a new PWI programme that had contracted with the Rehabilitation Services Administration to establish relationships between rehabilitation facilities and the local data-processing business community in 15 states (this was the same group that Crossroads had initially contacted). After assessing the programme's potential benefits, STIRC leaders invited IBM to establish a new computer programming training project for severely disabled persons.

*Designing technology projects with industry*

The project design required the setting up of a new type of computer Business Advisory Council. Top-level corporate executives would be asked to become senior partners in a cooperative endeavour to provide realistic training opportunities for disabled persons. From the start, the interest of the business community was considerable, as executives from leading American companies began to show concern. In 1978, encouraged by the BAC's leadership, the state

vocational rehabilitation agency awarded a three-year US$275,000 expansion grant to set up the programme.

The computer BAC soon expanded to 65 members and established various subcommittees, including admissions and placement, curriculum, business education and hardware, and planning. News of the commitment by the business community provided state-wide media exposure and a flood of applicants for the first 12 training slots. The first three classes led to 100 per cent placement, including many persons with disabilities that were previously considered too severe for services.

The implementation of the PWI programme was a significant departure from the way in which STIRC had traditionally operated. The most important innovation occurred within the BAC, since this was the first time that members of the business and industrial community had been asked to participate actively in the planning, implementation and management of a project. STIRC was advised that if business people, accustomed to dynamic business practices, were to be involved in project implementation, they had to be used to the greatest extent possible; otherwise STIRC could expect to lose a valued resource. The Center undertook to continue involving the business community in all its training endeavours. The principal reason for a PWI project is to gear rehabilitation to the job demands of a community's business and industry and not to take on NT; however, in this era of increased business competition, it was inevitable that one would lead directly to the other.

One of the first benefits of STIRC's involvement with NT and business partnerships was a change in the mood and environment of the organisation, symbolised by the introduction of computers. Staff began to view disabled persons in a new light. Those who had previously been judged as too severely disabled for service consideration were now learning to perform tasks that most rehabilitation staff could not do – operate and programme computers. One homebound client, for example, was competitively placed without ever leaving his bed 50 miles from the Center.

Operationally, every other month, the BAC subcommittee chairpersons would meet together to plan and decide on general policy. The entire BAC met the other month, primarily for special activities such as disability awareness seminars, job fairs and graduation. Subcommittee meetings were often held in the member's place of business, which gave both staff and other members a chance to share the latest technological innovations in the host member's company. The BAC members were encouraged as much as possible to meet clients on the grounds that commitment is best sustained through direct involvement.

BAC members first needed to become more sensitive to various disability questions. Although formal disability awareness training worked well with the initial computer BAC group, STIRC's approach was to suggest and design specific functions that placed the business executive in direct contact with the client; for instance, screening prospective clients, visiting district vocational rehabilitation offices on recruiting trips, conducting technical reviews (final examinations) on client training assignments, hosting field trips, serving

as guest lecturers, surveying business and industrial plants for architectural barriers with clients using wheelchairs, making joint presentations before professional groups, providing clients with practice job interviews, meeting informally at social gatherings, providing work experience for clients, and providing other direct placement assistance.

### *Technology expansion and infusion*

Acting on recommendations from the BAC, STIRC then developed a complementary technology training programme in information processing in 1982. In 1983, it received a federal PWI grant which allowed it to expand the BAC concept to other training programmes, with similar success. It was soon discovered, however, that BAC groups and training departments can differ, and what may have worked with the computer BAC did not necessarily work with, say, an upholstery BAC. Small shopowners generally could not devote as much time to their respective projects as data-processing managers. It was also learned that one BAC could be an excellent recruiting tool for another unrelated BAC. Again, under the various BACs funded by the PWI grant, an average of one new training programme was added each year. STIRC's management wisely decided that no new instructional equipment funds would be allocated without prior approval by the BAC. Thus, the BAC members were given the critical task of discussing what NT the Center should invest in, and their recommendations added credibility to STIRC's budget requests. During this time (1983-87) the infusion of NT continued with new programmes in telecommunications, computer graphics, CAD-CAM, digital equipment repair, and micro mechanical training.

With the resources now being allocated to the development of new training areas, and with the management complexities associated with multiple BACs, the original computer programme was losing some of its placement effectiveness. The original members of the BAC were called upon to assist. A strategic planning committee was developed and marketing consultants were brought in to review the programme. It became obvious to the BAC and rehabilitation staff that the programme had lost its competitive edge, as many other two- and four-year colleges were training business programmers, some of whom also were disabled. However, this was also the time when IBM was introducing its next generation of minicomputers, the AS/400 series. With some assistance from IBM, the Center received a first shipment of these new computer systems; yet even before they could be installed, the 1988 placement rate had risen again to nearly 100 per cent. This experience underscores the significance of maintaining momentum is a highly successful programme. A programme must be at the cutting edge of technological change and highly sensitive to market shifts in relation to curricular focus and placement strategies.

In 1989, the trend continued as a new training programme in customer service was added. This had to develop a state-of-the-art audio and local area network (LAN) for a new training laboratory. At the time of writing a BAC was

being recruited to establish a personal computer specialist training programme that might offer career options in desk-top publishing or computerised accounting. In addition, a strategic planning committee is working towards linking STIRC courses to homebound clients and others not able to reside at STIRC. Finally, an accommodations centre, staffed with a rehabilitation engineer and other support personnel, is planned in order to provide direct services to disabled persons and employers' organisations seeking technological solutions to problems at the workplace.

*Summary*

Following this 12-year history with NT, all training areas have integrated into their curricula the most advanced technology and training equipment available. Area manufacturing firms often send their employees (including former STIRC graduates) to visit STIRC to view and train for new technologies that their companies wish to adapt. STIRC management has given every encouragement to adapt technology to the Center's needs. Each training programme is supported by volunteer advisers from industry, who recommend or endorse curriculum changes and equipment acquisitions and help the Center's management to forecast technological trends. In 1989, STIRC placed over 90 per cent of the 245 clients who completed vocational training programmes, including 150 people identified as severely disabled. While many of the programmes and staff members have received awards for innovative and dedicated efforts, the real heart and soul of the programme, according to the staff, are the 200 business volunteers who serve on the 17 Business Advisory Councils.

## Discussion

While the experience of both these rehabilitation centres appears quite similar, there were some distinct contrasts. For example, they differed in how they became involved with NT. At Crossroads the process was largely an internal one. Initial contacts to establish support for the concept grew out of a long period of organisational and environmental analysis and strategic planning. At STIRC the process was more external, with IBM's first contact being the key factor in the Center's involvement with NT programmes. However, regardless of their approach, each centre was able to establish the type and level of support required to implement these exemplary programmes.

Another distinction between the two centres relates to differences in their respective missions. Thus, while Crossroads, with its comprehensive mission, developed a number of innovative vocational training NT programmes, it also strongly encouraged the introduction of technology throughout all its programmes. This multifaceted application meant that for financial reasons only a limited number of vocational training programmes were in fact initiated. In contrast, STIRC, with its singular vocational training

mission, has continually expanded its training options since the late 1970s. They now offer an array of career training programmes in technology-related occupations, as well as using technology in their administrative processes. Thus the concentration of resources on these options assisted STIRC in developing these many alternative training programmes. With these distinctions borne in mind, what were the critical factors inherent in these two cutting-edge organisations, or within their immediate environment, which enabled them to succeed with NT programmes, where others had not?

## *Critical factors in developing NT programmes*

A number of critical factors appear to have contributed to the centres' overall success with NT programmes. Although each adopted a different approach, each came up against a remarkably similar set of challenges. The most fundamental initial challenge they shared was that neither had the necessary internal technical staff. This meant that each centre had to develop new relationships and forge coalitions with business and industry to gain access to the technical expertise required. This recognition of the importance of using private sector resources, rather than hiring technical staff to develop the programme, was a significant policy decision made by each centre. Once these relationships were established and the partnerships began their work, a highly interactive environment was created, leading both to process benefits and to the eventual success of the programmes. While one cannot clearly identify which were the most important elements, it does appear reasonable to identify those factors which consistently contributed to the centres' ability to innovate through the application of technology in their respective vocational training programmes. The remaining sections of this discussion are devoted to these factors.

### *Significant organisational characteristics*

These included a strongly held sense of mission and a clearly articulated set of values that established a foundation for a developing professional culture within each centre and subsequently guided programme development expectations. Exemplary management leadership and a particularly strong participatory management style were apparent throughout each organisation and contributed to a sense of responsibility shared by all staff for the assessment and planning of future initiatives. This type of intellectual dialogue among staff and administrators produced an environment where creativity and innovation were highly valued.

Both centres appeared to understand the need for a dynamic innovative approach to service delivery and recognised the need to transform each centre into a competitive market-driven organisation. Accurate organisational self-assessment and strategic planning also appeared to be key elements. Previous experience with volunteer groups and advisory councils helped the

centres to attract and work closely with the business community. Finally, both centres appeared to have important resources (e.g. strong committed professional staffs, adequate facilities, highly supportive and visible boards, financially solvent organisations) and community support to take risks in these NT training areas.

### *External technical assistance and consultation*

In both Crossroads and STIRC, the BACs established to support the individual technology programmes provided the technical assistance which the organisations lacked. However, unlike other advisory council mechanisms in use in education and human services, these BACs were active in all phases of the projects, including their initial design and development, implementation, and continuing maintenance and renewal. The BACs consequently acquired a unique sense of ownership of the project, which enhanced their contribution to the objectives of the project as well as to the centres' mission and services as a whole. The help of these advisory groups was critical in assisting the centres to attract qualified technical staffs for the individual projects, to keep the training curricula and technological facilities relevant to the market's needs, to open up internship and career opportunities within the community for programme graduates, and to heighten the visibility, awareness and credibility of the training programme in the business sector. Other important contributions included developing "engineering committees", composed of engineers from participating BAC firms and centre staff, to assist with equipment and workplace modifications and for general consultation on the infusion of technology into training programmes and the administrative aspects of the organisations.

One factor that appeared to make these advisory councils so effective was the recognition by the centres of the need to involve the BACs in all aspects of the project, thus establishing a network of advocates in the business community to assist with the eventual placement of the projects' graduates. Both centres also found that BACs established to support highly professional career training (e.g. computer programming) were more likely to be effective than those supporting training in areas where skill requirements and professional identity were minimal. Finally, those projects that had clearly identified work roles for the BAC members and were highly goal-oriented seemed also to be more effective.

A skilled and sophisticated managerial and professional staff was required in each centre to attract, develop and maintain business participation in this type of advisory council model. One of the primary issues faced was that of project control, which represented both a key variable to the success of the projects and, at times, a potential obstacle. The BAC model used by both centres required active participation by private sector advisory council members in project policy formation and in some of the operational areas (e.g. curriculum and facilities, student selection and evaluation) of the training programmes. Both centres reported that, while the tangible benefits of these

working relationships were apparent from the onset, the sharing of project control with the business sector represented a very different way of doing business, and one that took some time to master.

In both centres the training programme's project director was a rehabilitation staff member from the centre, working closely with the chairperson of the BAC who was selected by fellow BAC members from the private sector. To maintain project control, the project director was the final decision-maker for the training programme and the key link between the BAC and the overall centre administration.

Both centres also appointed key high-level rehabilitation staff as permanent members on all subcommittees. In this way all issues were examined and decided upon from both the technical and the human service standpoint. Both centres also selected BAC members carefully, and placed great importance on providing intensive briefing on the project and on the functions of the BAC. It was understood that interpersonal and marketing skills were important in this regard, together with management knowledge of how to acknowledge business participation. While some rehabilitation staff were somewhat reluctant to relinquish complete control over all project decisions, the benefits of having this level of external consultation and participation in the projects' activities outweighed any negative consequences.

### *Impact of effective technology partnerships*

The success of these programmes was directly linked to the relationships established between the organisation, the business sector, the external rehabilitation and educational community, and the consumers (i.e. the clients trained under these programmes). While technology was consistently seen as a major advantage in meeting clients' needs and in opening up career opportunities for severely disabled persons, it was the interaction between the various members of these groups that established the foundation for the programmes' success. These extraordinary interactions brought tangible benefits to the clients, the business community, and the rehabilitation centres themselves.

In relation to the clients, it provided a unique opportunity to work together with representatives from the business sector throughout their programmes. This contact and continuing dialogue appeared to facilitate learning and the preparation of clients for eventual employment. The partnership also offered the students access to state-of-the-art assistive technology; and probably most important, through "mentorship programmes" established by both centres, student and business representatives formed close one-to-one partnerships which focused on placement and employability, and provided the student with an important professional advocate in the business environment.

For the business representative, the project provided an opportunity to make a tangible contribution to a worthy and highly visible community mission that also met businesses' needs for highly trained and qualified professionals entering the workforce. In addition, through close working relationships with centre staff, the business member became well acquainted with the

objectives of rehabilitation and the roles of the professional staff. The project enabled the business member to have close working contacts with severely disabled trainees. These non-stereotypic relationships eventually led to the development of healthy, normal attitudes towards disabled persons and also served to heighten expectations for the success of the programmes.

For the centres too there were many additional benefits. Through staff relationships and regular contact with business, the rehabilitation professionals began to see themselves on an equal footing with business people, and gained a personal understanding of business attitudes to the many problems met by the projects. This contact led to a reciprocally beneficial relationship between the centres' staff and the BAC members which served to bring to the meeting table the individual strengths of both parties, resulting in a flow of intellect which remained one of the cornerstones of the success of these projects. In addition, the staff's expectations of "what was possible" began to change as they witnessed the benefits of the business partnership. They realised that, with the appropriate technology, effective community partnerships and active mechanisms to confront attitudinal barriers, people previously believed to be too severely disabled could be competitively placed in highly valued career areas.

### *The process of technology innovation and infusion*

One can observe a generally similar pattern of experience over this 15-year period. Both centres appeared to progress through four distinct periods of growth in NT application: an organisational and strategic planning stage; an intensive and high-energy technological innovation phase where specific training programmes were designed and implemented with the assistance of the business community; a maturative, strategic planning and technology infusion stage, where new innovations slowed, and the centres began to plan and retool for the next phase; and a further innovation and programme development phase.

The environment and activities during the third stage of this process appear particularly important to sustaining momentum and growth in NT training programmes. For example, during this stage at Crossroads, after four years of successful intensive innovation and programme development the process slowed dramatically. The basic questions at that time were, "Where does the Centre go from here?", and "Have we reached the end of this line?" As with any innovative process, the initial stages are new, exciting and rewarding. However, maintaining excellence and momentum is difficult and sometimes exhausting. Concurrently, at Crossroads, the programme was becoming aware of significant market shifts in the skills required of new graduates of their computer programmer training project. They were becoming increasingly aware of potential competition from community colleges. The initiative with which the Center eventually responded to these events was critical to the programme's continuing ability to innovate and remain competitive. During this period the programme developed a university affiliation which allowed

students to earn college credit for their work in training, and embarked on a dynamic strategic planning stage which resulted in the retooling of facilities and curricula (e.g. a change from mainframe to microcomputer technology) and the expansion of the BAC. Therefore, the ability to show initiative in planning appears to be a critical factor for continued success.

Another key factor in the success of the NT programmes appears to be the degree to which technology can be blended with other traditional programmes and services offered by the organisation. Rather than viewing these new programmes as isolated initiatives, each centre committed its resources to develop related technology training programmes as a complement to existing programmes. Elements of these existing programmes were applied to the more traditional training offered by the organisation. For example, STIRC developed a computer literacy course in which all clients participated, regardless of their specific career training. At Crossroads, specific elements of the word processing training programme teaching basic skills (e.g. typing, reading, grammar, use of the computer) were made available both to clients in other technology training programmes and to those in more traditional areas of training.

In summary, all the above factors appear to have had some impact on each centre's ability to introduce NT in the development of specific career training programmes for severely disabled persons. While one cannot determine through the present study which factors or combination of factors contributed the most to the programmes' success, one may say that, taken as a whole, these factors represent the organisational keys to the success of two exemplary rehabilitation centres.

## Conclusions

There is no doubting the powerful role that technology has played and will continue to play in changing the world in which we live and the environment in which we work. However, no matter how exciting NT may be in its promise of providing new career opportunities for disabled persons, it must be part of the solution or it will soon become part of the problem. While NT training programmes such as those discussed in this chapter have been highly successful in assisting disabled people to enter dynamic new careers, technology alone was not the key. It was a powerful enabling element in overcoming physical barriers to career entry, in the same way as the community partnerships (BACs) attempted to provide mechanisms to assist the client to overcome attitudinal barriers and obstacles faced in the workplace. Finally, much can be learned from the experience of these two cutting-edge institutions with regard to the development of technological training programmes and the infusion of technology within their respective service delivery systems. The following observations are put forward for consideration by other rehabilitation organisations:

(1) rehabilitation centres wishing to develop NT training programmes need to adopt a competitive market-driven organisational philosophy, and develop sophisticated management, strategic planning and human resource capacities;

(2) government and private funding should be made available to such organisations to develop NT training programmes in partnership with the business sector and the community, utilising a PWI model of service delivery;

(3) rehabilitation organisations need to adopt leadership and management styles that foster creativity, reward innovation and tolerate reasonable risks in seeking creative technological solutions to the environmental obstacles associated with disability issues; and

(4) applied research associated with further demonstration projects is needed to identify key factors in the development, implementation and maintenance of technology training programmes, and to measure the direct impact upon the consumer in relation to both immediate employment and career development and advancement patterns.

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# Part III. New access technology and the employment of disabled persons

# 6

# Computer-based technology for disabled persons in working life: a holistic approach

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## Rationale for the project

Swedish labour market policy has long been distinguished by the fundamental conviction that unemployment is of primary concern to society and that a principal task for government is to keep it as low as possible. This policy is deemed to be equally valid for disabled persons. In order to combat the consequences of unemployment and underemployment, the Government, acting within the framework of the general labour market policy, has pledged itself to take both general and selective measures to improve the employment prospects of jobseekers who are insecurely established in the labour market. In accordance with these principles, special measures on behalf of the occupationally handicapped constitute a firmly established tradition of Swedish labour market policy.

Within the general framework outlined above, it is the task of the Swedish Labour Market Board (AMS) and the County Employment Boards to make these principles operational. The main resources for this in the AMS organisation are the employability institutes with special resources for disabled persons (AMI-S).

AMI-S activities are directed towards jobseekers who, on account of their disability, need special resources in order to find, obtain or retain employment. There are about 35 AMI-S institutes in the Labour Market Administration, distributed over the entire country. Each AMI-S is concerned with a specific disability (visual or mental impairment, etc.). Staff from these institutes played a major role at the start of the TUFFA project and have a decisive role in its operation.

The activities of AMI-S institutes emphasise the following points: placing vocational rehabilitation in the context of employment counselling and emphasising the labour market policy objectives for activities; making specialist knowledge more widely available through emphasis on the consulting function; and using society's total rehabilitation resources better through a greater emphasis on internal and external cooperation.

[1] TUFFA Project, Swedish Labour Market Board.

The jobseeker-oriented activities conducted by AMI-S institutes have the following principal objectives: to help unemployed jobseekers to gain access to the employment sector as quickly as possible, according to their individual abilities; to make it easier for occupationally handicapped jobseekers to play an active part in the employment sector and strengthen their position there; to facilitate adequate decision-making by jobseekers in order to solve their problems; to make it easier for jobseekers to acquire the knowledge and experience required for employment; and to enhance the employment prospects of persons now out of the labour force. These objectives apply to all activities: placement, employment counselling and vocational rehabilitation.

Slowly but steadily, during the late 1970s and the 1980s, computer-based workplaces became common in offices, workshops and factories. The computer was a new artefact, little known in the vocational rehabilitation world. At first, few realised the potential of computers in overcoming disabilities, or that, within a decade, many people would be using computers in their daily lives. Computers, especially microcomputers, could offer greater opportunities to disabled persons if they knew how to handle them. The obstacles to entering the labour market could increase for those who did not keep up with these developments.

By and large, the Labour Market Administration had no working knowledge of this new technology (NT). Individual enthusiasts working on their own account began but could not pursue it, for obvious reasons. A greater effort was necessary. In 1985 the Government and the Ministry of Labour decided to launch a major project to strengthen the position of disabled persons in the job market, to increase knowledge and to have more disabled people working in new fields, especially in using electronic equipment and computer-based technology. AMS was given the task of carrying out the project.

## Organisation of the project

Although AMS was mainly responsible for the project, other agencies cooperated. The Department of Industries and its agency, the National Board for Technical Development (STU), had been involved at the planning stage. STU ran a number of programmes connected with the new project, i.e. in information technology, in technology for the disabled, and with a scheme for technical procurement whereby the public sector would promote technical development in industry to meet its needs.

STU was a natural and a strong partner for AMS in the project. The Swedish Handicap Institute and the Swedish Board for Administrative Development were also involved. These four agencies established a steering committee for the project, which, it was decided, should be run as a technical procurement project. However, it was clear from the very beginning that a successful project would have to encompass more than technical development and manufacturing. We identified the following five areas which had to be

considered in the local project: training of staff (mainly at AMI-S); development of the organisation; development of training for jobseeking applicants with various disabilities; technical development; and development of knowledge of the physical workplace and its psychosocial environment.

It was foreseen that a large number of adaptations based on computers and electronics would entail considerable expenditure. To keep costs within reasonable limits, it was necessary to find ways to reduce the number of failures and drop-outs. A holistic approach was necessary from the beginning, and this need became more pronounced over time.

The scheme for technical procurement consists of nine steps which are carried out consecutively: analysis of demands; preliminary specifications of requirements; orientation of suppliers, developers and entrepreneurs; asking for tenders; tender assessment and contracting; technical development; testing and assessment of prototypes; revision of the preliminary specifications; and procurement on a regular basis. It was decided to follow this scheme as closely as possible, with variations only because of specific problems involving the basic objectives of the project as a whole.

## *Specification of requirements*

The analysis of demands was implicitly carried out during the preparation stage of the project. Thus, the specification of requirements became the first step. The preliminary specification was to form the basis for the forthcoming procurement of equipment for the workplaces.

A large number of persons, principally from AMI-S institutes, were organised into four groups for different disability areas: visual, auditive, physical (PH) and intellectual (IA).

Members in the vision group and, to a lesser extent, in the physically disabled group were found to have experience with computer-based aids. The two other groups had practically no experience with computer equipment as aids for disabled persons at the workplace. The lack of genuine knowledge based on research was striking in the IA area. Altogether, 35 persons were engaged in the four groups. Because a large number of persons had had widely differing experiences, the specifications resembled a "wish" list, and it became necessary to think of specific measures so that the specifications would not frighten away prospective bidders.

## *Procurement*

In general, technical procurement aims at both the procurement and the construction of a limited number of technical items according to a specification. In the TUFFA project it was decided that the technical equipment, whether developed within the project or not, was to be tested and assessed in its final environment (see Annex 1). This was thought preferable to setting it up at an institute where it would be tested as if in a laboratory.

Assessment at a worksite where disabled people had regular jobs would have important advantages: the contractor, who would later make regular deliveries to a large number of workplaces, would be forced to adapt to the real-life situation at the workplace; problems which do not occur in a laboratory could not be avoided at regular workplaces (e.g. character of tasks, job content, relations with immediate supervisors and colleagues, etc.); and the influence of the disabled person would be felt most at the workplace, thus avoiding misjudgements about the characteristics of the functional disability and the consequences for the demands made on the technology.

Testing on the jobsite also has drawbacks, however: it is sometimes difficult to gain access to the test site; and irrelevant disturbances can spoil the test (in an extreme case, the person under test may leave the job before the tests are completed). None the less, the advantages were considered to predominate, and the steering committee decided to select ten workplaces.

The prototype installations seem to be useful, since even though the prototypes were developed carefully, modifications have been made after practical testing at the worksite. These were at the request of either the client or the contractor.

The contractor was given total responsibility for the whole delivery. In the project, different levels of warranties are specified. These apply in different circumstances, depending mainly on the competence of the vocational therapist responsible for the disabled person concerned (see Annex 1).

The most far-reaching warranty is the *functional guarantee*. In this case the contractor takes responsibility for the specification of requirements for a given case, provided that the disabilities of the individual have been evaluated correctly. This means, for example, that the contractor has to exchange parts of the equipment if they prove unsuitable, try other application software, or provide more adequate training. If, on the other hand, the AMI-S takes more responsibility as the acting client in a given case, lower levels of warranty may be applicable.

Experience from the prototype phase has been passed on to the ordinary procurement scheme, regularly operated by AMI-S institutes and the County Employment Boards.

For the TUFFA project it was decided to use a principal supplier because installing a successful computer-assisted workplace for a disabled person is not an easy task, and is one for which knowledge and experience in many areas are required. Many small suppliers are still under the impression that equipping a workplace for a disabled person amounts mainly to supplying an ordinary computer with a few peripherals and then the device will work by itself. This is of course not true. Many other aspects are equally important. The psychosocial aspect is particularly critical, as for instance in the relationship between disabled persons and their colleagues and the foreman. Each workplace is different – available assistance at the jobsite, communications, interior design of the premises, and so on. These are only a few of the important aspects of workplaces that must be taken into account when NT is applied. A holistic view of all the components is absolutely essential. We think that only a bigger

company can cope with both the financial aspect and the time-consuming work involved in building up knowledge and experience. At a later stage, a free market could perhaps be established. In countries larger than Sweden, it may be possible to plan differently.

As mentioned above, our idea of using one principal supplier is linked to different levels of guarantee. The main point here is our insistence that the supplier should give a functional guarantee: that is, as we saw above, when the supplier has accepted the primary analysis of the disability and the workplace, he will guarantee that the equipment will work properly. Otherwise he is required to make modifications until it functions according to plan; such changes are to be made at the suppliers' own expense (see Annex 1).

### *Training*

All personnel with tasks related to the installation of microcomputer workplaces for the disabled have had at least one week of relevant training (see Annex 2). Five training centres in computer operation for disabled people have been established in Sweden, three of which are for the visually impaired and two for the visually and physically impaired person.

## Project status today: Some case studies

During the first year of the active phase of the project, the number of installed workplaces was below 400. The expected number was set at 500 per year in order to reach the goal of 2,000 in four years. Out of the 400 or so workplaces, we present documentation for a few of the users. Unfortunately, limitations of space do not permit us to give full details.

### *A blind physiotherapist*

The first case is that of a blind physiotherapist. The user, *A*, a 25-year-old woman, is a qualified physiotherapist and totally blind. She had not worked with computers before. *A* is very energetic and has learned the main uses of the equipment very quickly. However, she has not learned some of the features because they are not documented well enough (or not documented at all) for a blind person to benefit from them. At present, *A* works half a day at a hospital as a physiotherapist and the other half-day she receives patients in her home. At the hospital she receives certain administrative help, as do all the others. However, she has to do some administrative work herself, and must also be able to search through documentation. In her office at home, she has a much greater need to handle all the administration herself. The chance of her obtaining help for this are limited.

*A*'s workstation at home is based on a CAMPUS computer with expanded hard-disk memory. Extra aids especially for the disabled are a voice

synthesiser, a Braille display, a Braille printer and a typewriter. Her software includes a word processor, a multi-program, a display reading program and a specially developed database program for medical terminology.

It is important for *A* to be able to keep up to date with the necessary literature, especially reference books. For this reason a medical dictionary (Lindskog and Zetterberg) was put into a database for her. The book has 620 pages of entries and explanations. The database was prepared with an advanced optical reader which transferred the dictionary's contents to a magnetic tape.

*A* says she gets a great deal of use from her equipment, and uses it much more than she had at first expected. She has not used the medical dictionary very much – she is very knowledgeable herself and she has not had so many patients that it has been needed. As *A* uses the equipment more and more, she sees new uses for it, and her list of requests is increasing.

*A*'s case has shown that more training should be provided when the equipment is put into use. A blind person who cannot read the manuals needs more training in how to use the computer. After a time, additional training is needed if users are to exploit all the features that they could not assimilate at the beginning.

*A* emphasises that there is a need for manuals on diskette and in Braille, so that she could look up things for herself. Voice recordings on cassette tapes are a help, but it is difficult to find specific passages since the recording is continuous.

### *A materials planner with impaired vision*

In another case, the user, *M*, a 27-year-old man, has weak vision and works as a materials planner and purchaser at a wood factory. During this project, *M* amply fulfilled the expectations placed in him. He clearly showed that, in the workplace, technical equipment can help to compensate for a functional disability. Throughout this period, *M* was very much aware of what he expected from the technical aids and thus made a large contribution to their design. He is very interested in getting more training on this equipment in order to take greater advantage of its possibilities in other areas as well.

*M*'s company makes windows and indoor glass units. *M* has been employed there for six years. Because of his visual disability, *M*'s duties were somewhat limited. At the beginning of the project, the idea was that the technical equipment would compensate for *M*'s weak vision and thus expand his area of responsibility in materials handling so as to include a larger range of products and a purchasing function. *M*'s duties also included the supervision and control of the company's wood dryer.

*M*'s own development, and the support he had from the technical equipment, have increased his work area in materials handling and purchasing more than was intended at the beginning. Since the start of the project, the company has also expanded more than expected, and this added to *M*'s workload. The wood dryer has been supplemented by two more drying chambers.

These are now served by another person who does this alone. Tests have verified that *M*, with the equipment he has received, could otherwise have carried out all the work intended from the beginning.

During the course of the project, the company changed its internal materials-handling system from Master to Bravo. This is a network-based system, and *M*'s workstation is connected to it. The change meant that certain adjustments and supplements were made to the equipment.

*M*'s workstation is based on a CAMPUS computer with a large screen, connected to the company's network. Right from the beginning, an image-enlargement system supported by a speech synthesiser (Termivox) was supplied. This system provides speech through a loudspeaker and also enlarges the normal text on the screen. Printouts of all documents connected with *M*'s work come from three different printers, each of which uses different preprinted forms. Even before the project began, the workplace had a free-standing Magnalink camera-to-monitor system. When the Translator, Nova-Trans, was produced as part of the TUFFA project, it was installed with its camera, and the old equipment was removed.

The lists from the materials-planning system are usually quite long and compressed in order to give as much information as possible. For *M* to be able to read what he needs from these lists, TeleNova developed a special list-editing program, ListView. On the screen, *M* can select which parts (for example, columns) of the lists he wants, and can have this printed out in letters large enough for him to read with his normal glasses. ListView requires a certain competence from those who are to do the selection and editing of each particular list printout. It is relatively easy to use edited versions and they can be given to normal users.

To monitor and if necessary control the process in the wood dryer, special control software has been developed. The idea is not that *M* will use the computer to run the drying operation, but only monitor it. If anything abnormal happens, he can take the necessary protective steps. Tests have shown that communication between the monitoring unit and the computer works well, as do the control functions.

Both *M* and the company are very satisfied with the results at his workplace. The equipment itself works very well. However, when it arrived, *M* was very critical and unwilling to exchange his older equipment, which worked, for something new and untried. But the new equipment is still there. *M* was very pleased, but he naturally has some more requests now.

The work with the computer has led to a clear increase in interest in the possibilities this aid offers. More training in the general use of computers would be very welcome for *M*. The fact that the company's own computer department has people who are interested and knowledgeable has been of definite advantage for both *M* and the project.

### *A blind machinist*

*R*, a man in his fifties, has been blind since birth. He has worked with his present company for 30 years. He is very energetic in his work and constantly tries to improve his ability to manage, on his own, tasks from other manufacturing stages.

For many years *R* has machined bushings in a numerically controlled machine. When the type of bushing is changed, the machine is reset by special personnel: otherwise, *R* handles all stages of the job by himself.

One important part of the job is to measure the finished bushings and, if necessary, to adjust the set-up of the machine so as to obtain the correct results. All the bushings, of which there are about ten types, are measured in three dimensions. *R*'s machine has a control system to which a measuring system is connected. Measurements are recorded as deviations from reference samples. The measuring system includes jigs for measuring the inner and outer diameters and the height of the bushings. A voice synthesiser indicates the magnitude of the deviation via a loudspeaker. By memorising the deviations, *R* can determine if they are constant, in which case he can adjust the setting of the machine in relation to a selected bushing which has a significant deviation.

Under the TUFFA project, the equipment has been supplemented with manual measuring tools (sliding calipers and micrometers) to take absolute measurements, as opposed to the measuring system's relative measurements. These manual gauges are connected to a voice synthesiser which indicates the measured value in plain language.

The bushings have bevelled edges: to check these, a special bevel gauge has been developed. A selector allows the user to use the same voice synthesiser for the bevel gauge as for the hand measuring tools.

One of the purposes of this workstation in the TUFFA project was to develop equipment for general use that could be applied to operate numerically controlled machines and collect measuring data. The workstation is the only one of the 18 test workstations in the project that are directly involved in a manufacturing process. In general, the employer is very satisfied with the result. It has shown that someone with a functional disability can perform qualified tasks on the factory floor with good results, with respect to both quantity and quality. The company has given full support to the project and has said that it can well imagine employing other blind people in the future.

### *A student with communicative difficulties*

Another user, *U*, a 17-year-old girl, has a serious motor disability and cannot speak. Her main communication with her surroundings takes place via Bliss boards (which she uses very rapidly) and, to a certain extent, Blisstalk – that is, a Bliss board with a voice synthesiser. She has used a computer for a long time. To operate it she uses her left index finger and a keyboard with punched holes. *U* has a great need of communication with her surroundings.

The Adolfsbergs School has a special class for grades 7-9, with four or five pupils. The equipment supplied under the TUFFA project is based on a Compis computer with voice synthesiser and printer. The computer has been of great value to all the pupils. The software most used is Alfatext and Read and Write Training. For this, *U* uses a keyboard with a cover of punched holes.

For communication with her surroundings, she has a Blisstalk. The Bliss board, which has proved to be less suitable for *U*, has been supplemented with a Translator and a printer for providing printouts of the Bliss symbols that *U* selects. This provides the equivalent of the symbols' text in plain language, in large block print. The Translator can also be connected to Compis for entering the text in, for example, the AlfaText program and then editing it before printing it out on the other printer. This is not used at the workstation since the computer is at one workstation and the Bliss board at another.

The first model of Translator, NovaTrans Modular, was delivered to this workstation. It is specially designed for each particular task: in this case, to convert the symbols of the Bliss board in BLISSCII code to the corresponding words in ASCII so that they can be printed on an ordinary dot-matrix printer. Here, NovaTrans also designs the enlarged printout.

One of the tasks of this workplace, based on the Compis computer, was to produce printouts from Blisstalk. Modular's software Printout Editing is used to produce an enlarged printout which will help the user. In this software, certain characters and control symbols from Blisstalk are edited out. In the Compis computer, the text received from Blisstalk via Modular can be processed by Alfatext, which is much used at the workstation, for editing and correcting the text prior to printout.

*U* is a lively, energetic pupil who has really tried to use the computer in communicating with her environment. However, she has to work hard to control her irregular movements. She has not used the drawing programme since she feels it is too difficult.

The teacher has divided the workplace into two stations. One reason is that more pupils will thus be able to try out the computer. The results have been good. Unfortunately, this has made it impossible to implement one purpose for which it was intended: to use the equipment to retrieve data from the Bliss board for further processing in the computer.

After she leaves the Örebro school, *U* will return home to Västerås for continued training at a vocational secondary school. The Örebro school has contacted Västerås to determine what equipment *U* may need at her new school. Attempts are being made to contact the County Employment Board in Västerås in order to obtain continuity in her further move to the labour market. This will also be followed up centrally by AMS.

## *Non-traditional types of job for disabled persons*

There is no doubt that visually impaired people have enjoyed the greatest advantage from NT. In Sweden they are currently receiving more than

80 per cent of the total funds allocated to the technical aid sector. Also, most of the jobs held by this group are white-collar office jobs.

From the start, the TUFFA group has been planning to open up new areas and types of work for all disabled people. Giving examples of successful adaptations will broaden interest in this. It is obvious that to find enough jobs for all disabled people one must look beyond the world of offices. One good example of this is the workplace of *R*, the blind machinist mentioned above. Another example is of a severely physically disabled man who is going to get a job in a motor vehicle factory: here a personal robot has been combined with a microcomputer.

The potentialities of computers for intellectually handicapped people are enormous. In one case, the user, *E*, a man in his 40s, cannot read, write or count. His speech abilities are also limited. He has worked in a tent factory for eight years, where he has been engaged in the simple packaging of tent accessories.

*E*'s new equipment has considerably increased his production capacity, his stimulation and his motivation. It has also given him a somewhat higher social status and has aroused general interest among his workmates. As a result, *E* has grown considerably as a human being.

*E*'s work is to count tent accessories such as pegs, ropes, fittings, etc., and put these in bags. Previously, his work was limited to tent pegs. The pegs were put on a board with a mark for each peg. The work was boring and time-consuming. Later, *E* weighed the pegs on a scale. He could do this faster, but he sometimes made mistakes. The scale was not easily read and had a long stabilising interval. The TUFFA project arranged to connect an electronic scale to the computer. This is much more reliable and *E*'s capacity has increased considerably. In addition, he can now handle more components.

The workplace equipment was designed to help him to know what to pack and, above all, how many items of each. It is based on three main components: a menu board, a video display, and a scale connected to a computer at the foreman's workstation. The menu board has a number of hooks with push buttons above them. On the hooks, the foreman hangs plastic bags containing components. *E* selects the item he wishes to pack by pressing the button above the bag, at which point a lamp in the button lights up.

At the same time, the video display shows a picture of the component that *E* has selected. As *E* puts components on the scale, a blue bar rises higher and higher beside the picture of the component on the screen. When the preprogrammed weight is reached, the colour of the bar changes to green. The contents of the plate can now be put in a bag, which can then be sealed. If too many items are put on the scale, the bar changes to red.

When *E* feels that it is time to pack another component, he presses a new button on the menu board, and a new picture appears on his screen. Some bags contain different components. *E* keeps track of them himself, while the scale and video display help him to count the right number of each item. The ability to select by himself what he wants to count and pack has given him a significant feeling of freedom.

Special software has been developed for this type of workstation. VÄGA has been installed in the computer. This guides the user by showing him which components are required from case to case. The program also electronically weighs the number of components put on the scale. Each component to be counted, and the auxiliary data connected with this, are represented in the VÄGA program by a corresponding function key on a normal keyboard. The various buttons on the menu board are connected in parallel with these function keys. The electronic scale is connected to the computer, to which it continuously supplies digital information about the weight, and also reports if the weight is stable. The digital information is converted by VÄGA to the bar on the video display.

The program can also retrieve statistics on how much weight has been recorded for each type of component since the last statistics printout. This is presented both as the number of weighing/packaging occasions, and as the total weight per component.

To a certain extent this workstation has pioneered the use of a personal computer in helping an intellectually handicapped person to count. As indicated above, results have been very good. *E* has moved to a central position in the company, both with respect to physical location and as a source of interest. He was the first person in the company to have a computer (he and the company's managing director are still the only ones to have one). Not only has his output increased, but he also has a completely new sense of confidence in himself. Naturally, the company also greatly appreciates having a more satisfied worker, and the fact that he achieves more.

## Where do we go from here?

The problems encountered are still mainly those defined at the start of the project: our own organisation's ability to define the problem at the workplace, take the appropriate measures and order the right equipment; getting the employers interested in employing disabled people; controlling the principal supplier in order to get him to meet our demands at different levels and at the various field stations throughout the country; making advances into non-traditional job areas, e.g. moving out from the offices into industry, etc.; and getting people to make use of experiences gained elsewhere, either nationally or abroad. We are continually trying to find further training methods for our personnel so as to make the best possible use of NT. The main problem here is the enormous cost involved; however, there is also the problem of changing the work patterns in an established organisation which is set in its ways.

The reluctance of employers to employ or even try out disabled people on different jobs is a great problem. Information seminars, etc., are not enough. New approaches must be found. A new and deeper sense of responsibility is needed. Everyone must realise that, human society being what it is, people have different abilities and disabilities. Our common responsibility to give every human being as meaningful a life as possible must be as important a

task as making a profit in money terms only. We do not know yet exactly how to bring this about; discussions at an international level will be needed to get results.

# Annex 1

## NATIONAL LABOUR MARKET BOARD

**TUFFA Project**

Procurement form in accordance with the TUFFA agreement (to accompany order to supplier)

Name of jobseeker . . . . . .
Workplace . . . . . .
Address: town, city . . . . . .
Telephone . . . . . .
Customer . . . . . .
Address: town, city . . . . . .

Procurement according to model A, B or C
(Check the desired choice. See also next page.)

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A. Standard products only

Person responsible for specification . . . . . .
Person responsible for system . . . . . .

Delivery and installation requested
Instruction and training (about 4 hours) requested
Normal product warranty, 12 months
Extended product warranty, 24 months

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B. Workplaces requiring system adaptation

Person responsible for specification . . . . . .

Normal product and system warranty, 12 months
Extended product and system warranty, 24 months
Bid requested for user training

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C. Workplaces requiring pre-planning

Person responsible for specification . . . . . .

Normal product warranty, 12 months
Extended product warranty, 24 months
Function warranty according to specification

City _____ Area code _____ Date _____

Signature . . . . . .

**Supplier's undertaking**

*Procurement according to model A*

The customer is totally responsible for specification, based on work-related functional disabilities, system and product selection. This is recommended only if the workplace is simple, and the customer has much experience with similar installations.

The supplier provides equipment in agreement with the order. Follow-up of the delivery is done by telephone.

Product warranty is 12 or 24 months, as the customer wishes.

*Procurement according to model B*

The customer is responsible for specifications and also makes suggestions for system selection. If the supplier considers that the specifications or suggestion for system do not satisfy the requirements, the supplier will propose choice C (below).

The supplier develops the system and selects products (system adaptation), carries out system tests based on the specification submitted, and delivers and installs the system at the workplace. The supplier also provides instruction and some training in using the technical aids. Follow-up takes place within three months of delivery.

Product and system warranty, 12 or 24 months, as the customer wishes.

*Procurement according to model C*

The customer is responsible for specifications which, however, are normally worked out together with the supplier in a pre-planning phase. The supplier must approve the specifications.

The supplier is responsible for system selection and planning of the workstation, based on the specifications that have been produced.

The delivery is carried out as in model B (above).

Product and system warranty, 12 or 24 months, as the customer wishes.

The supplier also provides a special function warranty, which means that the supplier accepts responsibility that the system will meet the requirements of the specification.

*Miscellaneous*

At the request of the customer, the supplier must be prepared to supplement the system delivered to the extent required for the workstation to function even if conditions change. Swedish government regulations are valid for all deliveries.

After special agreement between the TUFFA project and the County Employment Board, bids may be taken for workstations requiring substantial system development or other new items, or intended for functional disabilities for which general knowledge is limited with respect to the use of computerised aids at the workplace (such as aphasia and intellectual handicaps).

# Annex 2

## *An overall view of disability, computers and work. Course for AMI-S personnel.*

*Contents*

Disability, computers and work: a working model
The work environment
Ergonomics and motor disabilities
Ergonomics and visual disabilities
Video display techniques
Lighting and video display work
Procurement
Labour rights and disabilities
Socio-economic calculations
Insurance rights and disabilities
Labour market policy and disabilities
The labour market up to 2005
Evaluating a human being
Focus on the individual
Informing, presenting arguments and influencing attitudes
Research and development
From the user's point of view
Cooperation
Case studies

# 7

# The contribution of new access technology to the employment of disabled persons in Japan

*Shinichi Okada and Takeshi Yatougo*[1]

Many devices and items of equipment for disabled people have been developed in Japan through the application of new technologies (NT) and have helped disabled people to gain access to the competitive labour market. These devices and items of equipment, commonly referred to as new access technology (NAT), make use of NT such as micro-electronics, robotic mechanics and biotechnology. However, no extensive research has been undertaken into either the present state of NAT in Japan or its effect on the employment of disabled people. Fortunately the ILO/RI volume of which this chapter forms a part presented us with an opportunity to examine this problem.[2]

The term "devices" refers to those tools which enable disabled people to use the standard machines found in the workplace. The term "equipment" refers to the machines introduced into factories or offices. Equipment is often adapted to enable disabled people to operate it effectively and easily. For example, microcomputers are classified as NAT equipment, and special keyboards for people with functional limitations in the upper limbs are classified as NAT devices.

This chapter covers only competitive employment, including self-employment; sheltered employment and supported employment are not discussed.

## The basic trend of NAT in Japan

### *Available NAT devices and equipment*

To support disabled people in various aspects of their lives, numerous devices and items of equipment are produced or improved through the applica-

[1] National Vocational Rehabilitation Centre for the Disabled, Tokorozawa City, Japan.

[2] The authors would like to thank those persons who kindly advised and supported them during the preparation of this chapter, the contents of which are the responsibility of the authors alone.

tion of NT. NAT devices and equipment have certain characteristics depending on the nature of a user's disability.

### *NAT for people with motor disabilities*

Because of the diversity of motor disabilities, the corresponding NAT devices and equipment tend to be tailored to individual needs and are rarely appropriate for others. They are used for mobility and for computer access. The typical devices or equipment for mobility are wheelchairs and improved motor vehicles, and NT is essential to produce or adapt them for individual needs. For computer access, microcomputers and word processors are indispensable. It is difficult for many people with functional limitation in the upper limbs to write letters by hand. Japanese typewriters require more manipulation and power to select and print each character than standard alphabetic typewriters, and have now been almost completely replaced by word processors. Standard or special computer and word-processor keyboards enable people with upper limb disabilities to communicate effectively through written languages. Therefore, computers and word processors are an essential means of communication, and of gaining entry into computer-based jobs such as computer programming, database management, and so on.

NT has helped people with extremely severe disabilities such as quadriplegia to live independently, enabling them to control their living environment through commands transmitted by breath control or eye movements. In addition, microcomputers have become an indispensable tool for communication and interaction with others, and in opening up new areas of employment. Supported by these environmental control systems, several persons with severe disabilities will begin to obtain employment in teleworking.

### *NAT for people with visual disabilities*

People with visual disabilities require devices which substitute for their vision or supplement their low vision. Visual information is critically important for daily living. NAT is powerful and helpful in improving mobility as well as in reading and writing printed characters.

The latest radar-beam technology and micro-electronics are being applied to devices such as walking-sticks and radar glasses which will help visually disabled people to detect obstacles and to walk more safely. Such NT devices are already on the market. Guide robots are a major NT research area, but a practical one has not yet been developed, and their conceptualisation will take a longer time. At present, guide dogs are superior to robots.

Braille is an indispensable means of written communication for the blind. However, in their social life, and especially in the workplace, visually disabled people have to read and write the printed materials used by sighted people. Microcomputers and man-machine interface devices such as the Braille display, voice synthesiser and large-print display make access to printed information possible, and visually disabled people can then write printed docu-

ments using microcomputers with the above devices and suitable word-processing software. They can also read electronic documents such as files on floppy disks. Through such NAT devices and equipment, people with visual disabilities can understand information in Braille or large print or transmitted by synthetic voice synthetiser. The direct reading of printed material is rather difficult owing to the use of Chinese characters in Japanese, and it is not easy to develop a reliable optical Japanese character reading system. OPTACON, an electronic converter of printed characters into tactile stimuli, is not able to read Chinese characters since most of them have very complicated forms. Interpretation reading machines must therefore be developed. The Agency of Industrial Science and Technology (a branch of the Ministry of International Trade and Industry) has been engaged in developing a practical reading machine and has succeeded in producing a prototype. It is expected that a practical reading system will be developed in the near future. Once people with visual disabilities obtain this powerful tool, they will able to expand their occupational potential.

### *NAT for people with hearing and communication disabilities*

NAT to counteract hearing and communication disabilities concentrates on substitutes for oral communication. Telecommunication through microcomputers has gradually been increasing in importance as a means of information exchange.

Facsimile is, however, the most useful communication device to replace the telephone for persons with these disabilities. Fax machines can be used by employees to inform their employers when they cannot come to work because of accident or illness. Consequently, it is considered that facsimile indirectly contributes toward the employment of people with hearing and communication disabilities.

### *NAT for other disabilities*

No attempts are being made at present to apply NAT to the promotion of employment of people with mental disabilities.

## *Use of NAT devices and equipment*

It is difficult to give statistics on the use of NAT by disabled people. However, the basic trend may be deduced from the available data, i.e. those obtainable from the only existing grant system for the purchase of NAT by employers for the employment of the disabled, which show that the number of NAT devices and items of equipment is relatively small but gradually increasing. The grants come from the quota and levy system described below. The data do not cover all disabled people using NAT devices and equipment at the workplace, since these people themselves, or their employers, have often bought

them without financial support. For example, grants are not available to civil servants or employees already employed by private companies.

The quota and levy system is operated under the Law of Employment Promotion of the Disabled. Private companies are required to employ a number of disabled persons equal to 1.6 per cent of their employees. Unless companies reach the 1.6 per cent quota rate, they must pay the levy corresponding to the shortfall. The levies collected are used for the adjustment allowance given to those private companies employing more disabled persons than called for by the quota. The purpose therefore is to equalise the burden of employing the disabled between companies. The levies are also used for various grants to employers who have taken on newly employed disabled persons, in order to cover necessary expenses.

The grants for the introduction of NAT or the improvement of existing equipment and facilities have opened up job opportunities for disabled persons, since they cover two-thirds of the cost of devices, equipment and facilities which employers pay to employ the disabled.

The following observations may be made regarding the use of NAT.

First, on the whole, the number of NAT-related cases is low, but their number and importance have been increasing.

Second, the extent of use of NAT devices and equipment is dependent upon the type of disability. While persons with a mental disability or loss of hearing use NAT devices and equipment very little, persons with physical or visual disabilities make considerable use of them. In particular, it is suggested that NAT devices are an indispensable means for the entry of the visually disabled into the competitive labour market.

Third, the use of NAT by persons with physical or visual disabilities is dominated by a combination of devices and equipment. The typical combination is that of a microcomputer (including a word processor) as equipment, interfacing with the required devices. For example, the combination of a word processor and a keyboard device enables persons with functional limitations in the upper limbs, such as cerebral palsy, to strike any key correctly and easily. For the visually disabled, the typical combination is that of a microcomputer and a device such as the Braille display, voice synthesiser or large-print display system. NAT is considered most helpful for the disabled in gaining entry to computer-based jobs such as database management, word processing and programming work.

The total number of disabled persons who benefit from these grants is slightly greater than the total number of cases, since one case sometimes covers several disabled people. Even taking into account this underestimation, the proportion of disabled persons supported by grants in relation to the total number of disabled persons employed is low, even lower than the proportion of disabled people supported by NAT. Companies tend to hire those disabled people who do not need additional or special devices or items of equipment. Consequently, we consider that the contribution of NAT to an increase in competitive employment of the disabled is rather small. The important contribution is in the improved quality of work and working conditions. In many

cases, to use NAT properly disabled persons must have a basic knowledge of their jobs; thus those working in database management or programming must be competent with computers or word processors. The importance of education and training thus has to be stressed as well as the importance of NAT, in order to enable the disabled to undertake new kinds of job and perform their work more efficiently and comfortably than before.

The requirement that employers should pay one-third of the cost does not seem to affect their willingness to employ the disabled. On the contrary, this system seems to offer employers a chance to introduce technologically advanced and more productive machinery as well as to employ more disabled workers.

## Examples of NAT cases[3]

### *A computer programmer with severe cerebral palsy*[4]

*A* is a young programmer working for a software development company. He has functional limitations in his upper limbs and a speech disability due to severe cerebral palsy. This case shows how a computer is a useful piece of NAT equipment enabling a person with upper limb limitations to gain employment.

Majoring in mathematics, *A* learnt programming with a microcomputer which was a gift for entering college. He received a certificate accredited by the Ministry of International Trade and Industry while he was a college student. After graduation, he was employed by a software company, but they could not find a suitable position for him. They worried about the severity of his disability and did not consider his potential. He left after four months, and approached another software company where he had previously worked part time. The president willingly hired *A*, believing that he could work as a computer programmer if he could maintain the same "output" as his colleagues which, with a computer and a keyboard, he showed himself able to do. Since then *A* has been working with the company as an indispensable staff member.

His job is to design management and purchase control programmes for customers. The president appreciates his competence and ability in the field of software design, and points out that it takes him longer to explain the software to customers and to create software documents. The president thinks that these problems can be resolved through collaboration with a fellow worker.

[3] See Annex for a description of some of the devices and items of equipment mentioned in this section.

[4] Based on Japanese Association for the Promotion of the Electronic Industry: *Research on electronic equipment accessibility in Japan* (Oct. 1989; in Japanese).

### *Economic independence through NAT for a person with quadriplegia*[5]

*B* is restricted to his home because of quadriplegia: however, he is living an active life through an environmental control system and a computer. This case suggests that even severely disabled people can achieve economic independence.

*B*'s daily routine begins in the morning when his wife and daughter help him to move from bed to a wheelchair. During the day he spends his time reading books, watching television and operating a microcomputer. In the evening he goes back to bed, has dinner and spends time with his family.

His daily life is dependent on an environmental control system with 15 switches for the air conditioning, lighting, television set, telephone and intercom, opening and closing of the front door, etc. He chooses one of the switches and turns it on or off by breath control. The system allows him to stay at home alone while his wife works and his daughter goes to school.

*B* wanted to write a letter, instead of asking someone else to write it for him. He thought of using a word processor and consulted a rehabilitation engineer about his idea. The engineer made a special keyboard device for him. Although he did not have any experience with computers, he was quick to learn. Next, he wanted to draw pictures and figures with a computer, and so the rehabilitation engineer developed another special device for him. He operates an electronic pen with his mouth and writes or draws computer graphics. He registered his computer graphic work with the Art Bank, which collects drawings for disabled people and introduces them to customers (e.g. publishers). Some of his work has been used for posters, book jackets or magazine covers, and this earns him money.

He uses a microcomputer to communicate with other disabled people. He thinks that informing others of his experience and encouraging his peers who have the same disability is an important task.

### *A blind computer programmer in a manufacturing company*[6]

*C* has been blind since birth and is now creating programmes to check electronic parts and the testing devices of those parts. This case shows that blind people can work efficiently as programmers even in the more hardware-oriented sectors. Massage and acupuncture are the traditional occupations for people with visual disabilities in Japan; 40 per cent of visually disabled workers are still engaged in these occupations. Unfortunately, alternative occupations are limited; however, computer programming is one of the most promising of the newer jobs and there are now more than 50 computer programmers with

[5] Based on "ASAHI personal computer", in *ASAHI Newspaper*, 1 May 1989 (in Japanese).

[6] Based on National Vocational Rehabilitation Centre for the Disabled: *Research on blind computer programmers in Japan* (Mar. 1989; in Japanese).

visual disabilities. Most of them are creating programmes dealing with business or scientific calculating; there are very few in manufacturing-related programming.

After graduating from college, *C* entered a vocational training institution for visually disabled people to enhance his employment potential. He learned computer programming and the use of OPTACON and other computer access devices for blind people. He was then employed by his present company, which manufactures electronic machines. Both the president and his colleagues were concerned whether he could work well, since he was their first visually disabled worker, and they had no experience of working with or even being with a disabled person. However, he proved how well blind people can perform in programming if they have suitable devices. Having developed and mastered the new programming languages necessary for his work, he now creates new programmes for using the keyboard and reading the display by OPTACON.

*C* points out that his experience shows that blind people can work as well as sighted programmers. When he must read specifications in print, he asks his fellow workers to read them for him. This kind of help is not onerous since his fellow workers are willing to assist.

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*A blind owner of a small business dealing with NAT and related software*[7]

*D* is totally blind and manages a small business which undertakes consultation, provides support and sells NAT devices for people with visual disabilities. This case shows that NAT devices for disabled people can open up business opportunities for disabled people themselves.

After graduating from postgraduate school *D* became a part-time high-school English teacher but was not satisfied with this because his position was not secure and he wanted to do something for his disabled peers. He then entered a vocational rehabilitation institution, where he learnt to use microcomputers and computer programmes concerned with NAT devices for computer access by visually disabled people. On completing his training he tried to enter employment but could not find a suitable job. As a result, he decided to form a company, with financial support from acquaintances. He now employs three people, two of whom are visually disabled.

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*Japan Sun Industries*[8]

Japan Sun Industries was founded in 1965 under the motto "No Charity, But A Chance". It started as a sheltered workshop for physically disabled people. As it increased the number of its factories and workers, it

[7] Interview by telephone on 10 August 1990.
[8] Interview with Mr. Hiroyoshi Ikata, Director of Operations, Japan Sun Industries, Beppu, Oita Prefecture, 30 July 1990.

shifted from low- to high-productivity activities. It now has three sites in Japan and employs nearly 900 disabled people. Furthermore, it contributes to sports and cultural activities as well as to the welfare not only of disabled people but of everyone in the local community.

Japan Sun Industries has been establishing close relationships with companies such as Sony, Honda and Omron. Sheltered workshops in Sun Industries undertake subcontracted production for these companies. Furthermore, some companies have founded subsidiary factories within Sun Industries, e.g. Omron Taiyo, Sony Sun, Honda Sun Manufacturing, Mitsubishi-shoji Sun and Denso Taiyo. These companies are responsible for production technology and management; Sun Industries is responsible for vocational assessment in the placement of disabled workers, their health care, and the provision of devices and adaptation of equipment and facilities.

Sun Industries has been actively introducing productive technology and improved production facilities for disabled workers. For example, work that previously required both hands can now be performed with one hand. Also, the examination of completed components can now be done by sound, so that blind people can carry out this work. The company is also introducing automation and robots. Although this may deprive some workers of their jobs, they can be absorbed in other production lines or take on new jobs, since Sun Industries has various factories and jobs with enough capacity to absorb displaced workers. For example, an examiner lost his job following the introduction of new automatic machines but was re-employed by a programming company as a programmer after on-the-job training. It is the philosophy of Sun Industries that the improvement of productivity will bring increased revenue for the whole company and therefore, ultimately, a bigger share to each worker. The company thinks that the introduction of production controls is as important as production technology itself.

### *Development of a large-print display system for people with low vision*

Our own experience with a large-print display system R & D project for people with low vision illustrates the importance of correctly identifying the needs of the disabled and transmitting this information to researchers and manufacturers, as well as of accurately informing disabled people about modern and updated NAT devices. People with low vision urgently need a new large-print display system that can be used with Japanese microcomputers. It seems that researchers and manufacturers are apt to pay more attention to totally blind people, and to ignore or misunderstand the needs of people with low vision.

To operate a computer one has to read characters on visual display units, a task which is difficult for people with visual disabilities. Some devices which convert information on the computer screen into Braille or synthetic voice have been developed to solve this problem. However, a device to enlarge characters on a screen for people with low vision has not yet been developed. In

the United States, these kinds of device have already been developed, but they cannot be used with Japanese-language microcomputers, which use Chinese characters.

The National Vocational Rehabilitation Centre for the Disabled planned to develop a large-print display system according to our basic specifications. The fundamental policy was to make a display system using hardware and software which could be used by people with low or normal vision, since they perform the same tasks. We enlisted the cooperation of an electronics manufacturer, started R & D jointly and completed the development in 1988. More than 160 of these systems are now being used in rehabilitation institutions, schools and workplaces.

It was difficult to estimate the demand for the device at the initial stage of development. The original goal of producing 100 units was set to avoid the risk of overproduction. Although initial costs were high, they may be looked on as an investment in future production and improvement. Since there is no subsidy or rental system apart from the grant system, the needs of disabled people with low vision have not been satisfied sufficiently. There is no nationwide network or database service in Japan, which makes it difficult to inform potential users of this new device. Therefore, the question of information services for NAT devices and equipment must be considered more seriously.

## Conclusion

Over 300 people have been able to enter competitive employment through the use of devices, improved equipment and facilities. The number of NAT devices and equipment is relatively small but gradually increasing, particularly when those purchased by companies and disabled people without grants are taken into account.

As regards the relationship between the types of disability and NAT, people with visual or motor disabilities tend to use NAT devices and equipment in the workplace more often. NAT is particularly important for people with severe disabilities such as total blindness, functional limitations in the upper limbs and quadriplegia, since it provides them with occupational opportunities, mainly in computer-based jobs. To promote the employment of disabled people, it is therefore essential to make greater use of NAT. The following suggestions should be considered carefully.

### *Development of NAT*

#### *Informing researchers and manufacturers of users' needs*

Researchers and manufacturers have developed NT, but do not provide information on its application for the disabled. On the other hand, both

disabled people and employers need these devices, but in many cases do not have the necessary technologies. It is therefore important to match and integrate the needs of users with those of researchers and manufacturers.

Furthermore, it is critically important for disabled people to participate as advisers in R & D activities and the improvement of NAT devices and equipment. The authors' own experience in developing a large-print display system indicates that the participation of the disabled from the initial stage of R & D is necessary to produce user-friendly devices and equipment.

### *Financial supports to R & D of NAT*

R & D activities are risky ventures since they call for substantial investment and sometimes result in failure. However, the level of the demand for devices by the disabled is extremely low compared with the demand for standard products. It is difficult to finance the investment cost for the former since profits through sales are limited. Therefore, grants for researchers and manufacturers are needed to stimulate R & D into devices for the disabled.

In the case of expensive R & D projects, public organisations have played an important role. The Agency of Industrial Science and Technology has undertaken ambitious projects, such as a vertically movable electric wheelchair, an interpreting and reading machine and a guide robot, which have brought about new technical "seeds" applicable in various fields. Similarly, the Ministry of Labour has a five-year project to develop micro-electronic devices: a synthetic voice word processor for the blind, a communication system through microcomputers for people with hearing and communication disabilities, and a vertically movable electronic wheelchair which stems from the Agency of Industrial Science and Technology project.

## *Use of NAT*

### *Extension of the grant system*

The grant system certainly has contributed to the promotion of the employment of disabled people. However, the present system needs extending and improving so as to promote the employment of more severely disabled people. Employers and disabled people have suggested that the limitations imposed on grants should be changed to allow for greater flexibility in several areas, such as extending the availability of grants for the duration of a disabled person's employment, and compensating for rapid changes in NAT innovations. NAT products and innovations are apt to be relatively expensive since the demand is small and economies of scale via mass production cannot be achieved. Users have suggested modifications to the grant system which would compensate for the costs and make innovations available to the disabled to increase their employment potential.

### *Information, demonstration and consultation on NAT*

At present, many disabled people and employers do not know where to inquire about NAT suitable for their use. Of course, NAT manufacturers or vendors cannot afford to advertise in the mass media in the same way as the manufacturers of mass production goods can. Furthermore, the degree and nature of disabilities are diverse, so NAT has to be tested by professionals, and their advice heeded. Therefore, information, demonstrations and consultation services on the use of NAT are essential.

### *Instruction, training and standards of NAT*

Many NAT devices require users to practise operating them so as to ensure their effective use. Therefore, short-term training opportunities for this purpose are desirable. Of course, this instruction service should be available in the workplace, at home and at institutions.

It is extremely important that the devices and equipment be safe to use. Reliable standards for NAT must therefore be established: the quality of these devices will then improve and disabled people will be able to use them more easily and more safely.

### *Vocational training of NAT users*

NAT users must have sufficient skills and knowledge in performing the jobs as a precondition for the proper use of NAT devices and equipment. Thus vocational training must be provided; it should cover NAT devices and include wide-ranging training for computer-based jobs.

## *The fundamental issues*

### *Comprehensive information network*

We have stressed the need for a nationwide information network. This network should have at least the following three functions: matching and integrating the needs of users with those of researchers and manufacturers; providing a database service that catalogues available devices and those being developed; and devising a support system like an "expert system" through which rehabilitation professionals can inform disabled clients about suitable NAT devices and assist in their selection.

This information network will make it possible rapidly to acquire information about NAT, co-ordinate operations between researchers, and co-ordinate the use of R & D resources. Some public organisations are now planning comprehensive database services on technical aids, covering all kinds of welfare services and both medical and NAT devices and equipment.

### *The disabled in society*

The employment of disabled people will not grow unless their right to work is accepted in society. If the integration of disabled people into society is not accepted, NAT devices and equipment will be unable to work effectively. NAT enables the disabled to bridge the gap created by their physical limitations and to participate successfully in the social and working environment. Society's ignorance of disabled people's abilities and knowledge hamper their chances of reaching their full potential. Society must first accept and understand the disabled for the people they are. The disabled desire only "Full Participation And Equality".

## Annex

Some NAT devices mentioned in the text are described here.

*Vertically movable electric wheelchair.* Workers are often required to stand and operate a machine or look out materials or monitor the current status of the workplace. However, it is difficult for users of standard wheelchairs to carry out these tasks. For this reason, the Agency of Industrial Science and Technology and the Ministry of Labour have developed a vertically movable electric wheelchair. Its seat can move vertically to allow the user to reach as high as a person standing up can. If necessary, additional functions such as voice control of direction of movement and a preprogrammed automatic movement system are available for individuals with severe upper-limb functional limitations.

*Keyboard/mouse device.* People with functional limitations in the upper limbs, such as cerebral palsy and quadriplegia, may have difficulty in using their fingers, or in using standard computer keyboards. Several devices enabling disabled people to operate keyboards are now available. One of these is the keyboard mouse which was developed for *B*. This device can be controlled by an electric pen which users operate with their mouth or have fixed to their hand. The device has two modes; the keyboard emulation mode and the mouse emulation mode. In the keyboard mode, the user inputs characters by touching a control display tablet with the electric pen. In the mouse mode, the user can use the pen on the tablet just like a mouse.

*OPTACON.* The name OPTACON is derived from "OPtical to TActile CONverter". It electronically converts optical information (such as characters taken by a camera) into tactile information through the up-and-down movement of more than 100 short pins. Using a small camera to scan a line of characters with the right hand, the user reads those characters with the left index finger through the tactile stimuli corresponding to the character forms. OPTACON was developed in the United States; it is very effective in reading alphabets but is limited in its application to Japanese, which uses Chinese characters.

*Braille displays.* These devices display Braille messages from computers by using small embossed pins. Compared with Braille printers, Braille displays have the advantage of real-time interaction with computers, silence and saving paper. They are often called "paperless Braille" and are suitable for office use.

*Large-print display system.* This device was developed by the National Vocational Rehabilitation Centre for the Disabled. Since the visual conditions of individuals with low vision are diverse, it can not only magnify computer screens but also alter the space between characters and lines or the colour of characters. In addition, it has various functions which enable disabled persons to use microcomputers easily.

# 8

# New technologies and the employment of disabled persons in Israel

*Emanuel Chigier, MBCh, MRCPEd, DCH*[1]

Although Israel is in the Middle East, it is basically a "Western" country in terms of lifestyle and in its use of technology. The standard of research and technical development is high. The small size of the population (4.25 million) and Israel's geographical distance from Europe and America have limited the development of new technology (NT) for disabled persons. However, there have been some interesting developments in this field. This chapter will deal with three aspects of NT in Israel: computer technology; access to technical information and consultation; and technical aids.

## Computer technology

The most active professional working on the use of computers with disabled persons is at present Dr. Alan Kirschenbaum, who is in the Faculty of Industrial Engineering and Management, Technion, Israel Institute of Technology in Haifa, and is the father of a young adult with severe brain damage (see Kirschenbaum, 1985, 1987, 1989, 1990; Kirschenbaum et al., 1986, 1987).

Under the auspices of the National Council for Research and Development he has carried out wide-ranging pioneer research on microcomputer-based aids for disabled persons. The approach was to work at grass-roots level by providing basic information to professionals in engineering, medicine and rehabilitation, showing them how to use technology for the benefit of persons with paraplegia, quadriplegia, muscular dsytrophy, blindness, speech defects or mental retardation.

### *Chordic keyboard*

An important breakthrough was the development by Kirschenbaum, Friedman and Melnik of a chordic keyboard for disabled persons (Kirschenbaum et al., 1986). Generally, interface units for disabled persons have concentrated on a small number of severely disabled persons. Such units are constricted in use, and conceived for a specific problem, usually for a single

[1] National Secretary, Israel Rehabilitation Society.

individual. The aim of the project was to search for a general solution covering a broad range of disability groups. A preliminary analysis of the characteristics of disabililty categories pointed towards the hand/fingers as a predominant ability area common to many types of impairments. The use of this common feature, which encompasses persons with motor, sensory and mental impairments, led to the use of a single-hand extension interface keyboard. The results were considered successful. Disabled persons with various impairments were able to operate a keyboard interface unit satisfactorily and consequently to interact with computers.

Typing proficiency varied considerably among physically disabled persons. The average number of words typed by a spastic cerebral palsy subject was eight words per minute. The lack of coordinated movement among those with spastic cerebral palsy is usually exacerbated by the increased effort required to perform an activity. The keyboard, which was designed to minimise such effort, apparently has a positive effect on the degree of coordination that can be attained by persons with a disability of this nature.

For persons with athetoid cerebral palsy with typically involuntary and unorganised movements, the fact that the keyboard requires practically no movement of the arm or hand allowed this disability group to reach an average of 13 words per minute with this interface unit.

Those with progressive muscular dystrophy (PMD) were able to reach an average of 14 words per minute at the end of the eleventh session of training, owing to the minimal physical effort required to operate the interface keyboard.

The chordic keyboard proved to be flexible and helpful to persons with various types of disability. Its physical design and cognitive operation allows persons who cannot type to interact with computers.

## *Technology transfer: The Ofakim project*

The microprocessor has been regarded as acting as a "middleman" between the disabled person and a task. The computer aid represents an equaliser, allowing the fulfilment or the completion of primarily physical tasks linking two separate worlds, i.e. technology, and its social use by individuals. It is accepted that the man-machine interaction is an active one allowing control by the disabled person, and the accomplishment of vital functions for employment, survival, pleasure or independent living.

Ofakim is a special education school with 60 students aged between 8 and 18 years in Haifa, of whom one-third are Arabs and two-thirds are Jews. The students have severe physical disabilities (cerebral palsy and muscular dystrophy). Small classes of from six to ten students allow for individual attention, but less than one-fifth of the students were able to use electric typewriters for employment, pleasure or independent living.

The research project of Ofakim School adopted a two-stage approach to activate the transfer process. The first stage involved an ergonomic selection

of both hardware and software applications. With regard to the choice of hardware, it became clear that the prime component was the psychomotor ability to access the computer easily and quickly. Account was taken of the end-user and the teachers, who would each day "set-up" the learning stations and carry out special adaptations. The second stage involved providing teachers and paraprofessionals with a basic working knowledge of computer technology, so as to overcome resistance. This resistance was based on factors such as a suspicion that their autonomy would be diminished, a belief that computers would not help or might even be harmful, and opposition to learning about "unknown" articles such as computers.

A course, approved and accredited by the Ministry of Education and given over a period of ten weeks to groups of six persons, resulted in a dramatic change in attitude and willingness to use computers in the classroom. The combined approach encouraged both teachers and students to widen the range of opportunities provided by the computer. Students who previously could not communicate were now able to do so. Others could do their homework, write letters and use educational games, all of which allowed them to advance rapidly in their studies. With the joint participation of teachers and students, studies were accelerated, more time was spent with the student and potential vocational consequences were assessed.

When one takes into account the social, psychological and engineering aspects of the computer, the end-user and the transfer agent (teacher), it seems possible to train both physically and mentally disabled persons to participate in the computer job market. The only requirement will be the need for appropriate applications to give access to computer systems to this special population.

## *Vocational training of computer-related skills for mentally disabled persons: An experiment in a community setting*

Following the success of the project at Ofakim Special School, Kirschenbaum is directing a project for computer skills training for mentally disabled (moderate to severe retardation) adults at Kfar Tikvah, a community (organised like a kibbutz) comprising 125 persons, and consultant professional staff (Kirschenbaum et al., 1987). The focus is on mentally disabled persons and towards employment in computer work. The objective of this research is to create and evaluate a programme which should increase the employability of mentally disabled persons through appropriate training in computer competency, thus leading to income-generating employment. It is hoped that the experiment could serve as a model for replication in other centres and other countries. This project is based on the Ofakim experience, and includes the following stages:

(1) a basic 32-hour course in computer use for all personnel from janitor to psychologist. The course is conducted in groups of five or six persons and is intended to change a negative or indifferent attitude into a positive, dynamic, helpful one;

(2) a computer club for mentally disabled adults. Five or six persons were involved, four days a week in the afternoon. It was expected that the number would increase to 10 to 40 members within two months. Students are subtly taught not to be afraid, and that computers are fun. Mentally disabled persons develop a sense of control, of interaction and of learning without harsh discipline;

(3) use of computers in the community secretariat, thus influencing both staff and mentally retarded persons to view computers as part and parcel of daily life; and

(4) group learning with opportunities for helping each other. Selected residents learn data entry and word processing and gradually develop applications to work and services. Initially, work will service the internal needs of the community; subsequently, outside contacts will be sought. The community has certain advantages when arranging contacts. There are no capital costs, and manpower costs are quite low because of the communal nature of the community. What may be boring for others may be considered a challenge for the mentally disabled residents and the work enhances their feelings about helping to run their own village.

We may deduce from the above that, since most data-entry workers require a lot of breaks at work and often leave because of "burn out", there is an opportunity for physically or mentally disabled persons to receive training and find contracts or jobs in the open labour market in the field of basic computer work.

## *Use of computers in employment for visually disabled persons*

Computer programming as a source of employment for blind persons and these with severe visual impairment was the basis of a research project carried out between 1968 and 1970 in the (then) Ministry of Social Welfare, under the auspices of the United States Social and Rehabilitation Services (see Chevion and Schiff, 1972). The course was attended by 49 blind or partially sighted persons, of whom 31 had migrated to Israel from countries in the Middle East or North Africa. It lasted one year, which is twice as long as courses for sighted persons. The rate of success as indicated by completion of the course and successful placement in employment was high, at 63 per cent. Conclusions were as follows:

(1) blind and visually impaired persons, after suitable selection (as also in the case of sighted persons), can be trained successfully as computer programmers;

(2) a blind or visually impaired person can do the work of a programmer successfully and his or her work can be compared satisfactorily to that of a sighted person;

(3) success in training is dependent upon the use of specially designed tactile aids and the adaptation of a training method of teaching the whole through the tactile and audible teaching of fragments, which is the reverse of the usual training procedure; and

(4) successful placement and acclimatisation depend upon the engagement of a well-qualified professional as trainer, who takes a personal interest in the trainee. It is also important that trainees be given an opportunity to carry out productive work as part of their studies in the training centre, to be followed by an experimental period of work for a period of time in a real installation before final placement is carried out.

When the research project was completed, the centre continued to function as a training centre, and was granted awards by the IPA (International Programming Association) and the Israel Ministry of Labour's Department of Productivity.

Results of the research have been distributed on request to over 20 countries in Europe and Asia and to rehabilitation agencies in the United States, and have been presented at international conferences or symposiums. Technical aid was given to the Computer Systems Institute, Pittsburgh (United States). A similar training system was established in 1970, under the guidance of one of the research team investigators in Finland.

Over the years, further blind persons received training and entered employment, while others dropped out. The major problem is that the rapid progress in computer technology has required further investment and the retraining of blind workers in the usse of the new equipment. At present, there are about 50 blind computer programmers at work in Israel, who received new equipment (including Braille terminals) in 1984. However, today there is once again a need for new equipment which, if not provided soon by governmental rehabilitation agencies, may lead to many of these workers losing their jobs.

## *Computers in special education*

In addition to the above reports relating to use of computers by students with cerebral palsy, or mentally impaired young adults, other projects going on in Israel are worthy of mention.

*Institute for Educational Technology, Tel Aviv*

This Institute is developing a programme on teaching reading ability through computers to children with brain damage, mental disability or severe emotional disorders. The approach is multi-sensorial, involving screen touching, voice activation (using recordings of a human voice) and graphic presentations in colour. Teaching materials have been developed and courses are now in progress. The teaching manual includes lessons on teaching reading ability, games and educational exercises, material for reinforcing the learning experience, and tests of the student's progress. The basic principles are interactive learning, making learning interesting and enjoyable, and providing maximal feasibility for teacher and student in moving along the path towards successful reading abilities.

*Youth Aliyah*

Since 1985 Israel, in general, and Youth Aliyah (which is an agency providing general educational and social educational services for immigrant and disadvantaged adolescents in residential settings), in particular, have been facing a tremendous educational challenge with the immigration of thousands of young persons and adults from Ethiopia to Israel via refugee camps in the Sudan. Youth Aliyah at present has 3,000 Ethiopian adolescents from 12 to 19 years old in its various residential centres, and over 700 have already graduated from Youth Aliyah. In three youth villages, computers have been used as part of general education and towards achievement of literacy and basic mathematical skills. Although no careful evaluation has been carried out (which is to be regretted), empirically it has been noted that it is possible to teach the language of the computer to illiterate adolescents who have never gone to school. Such students are able to reach a level of adequacy in computer usage which provides an opportunity for further learning and possible employment in data input storage. If this be the case, the implications are significant. Perhaps in dealing with the functional illiteracy of inner city youth, it might be useful to omit the usual learning and move directly to the computer usage. Such training is interesting, challenging, nothing to be ashamed of, and very much in favour. A combined socio-psychological and educational technological approach towards the achievement of literacy, and its implications for employment possibilities through training in computer usage, may be the breakthrough in the rehabilitation of millions of culturally or intellectually disabled persons.

*National Centre for Computers in Special Education, Tel Aviv*

At the special Education Division of Levinski Teacher Training College in Tel Aviv, a team of experts is involved in setting up this Centre. The work will be carried out in two stages: first, bringing the knowledge and the educational opportunities provided by the Centre and its activities to schools,

hospitals, residential institutions, child development centres, etc.; and second, transferring the knowledge to various "agents", i.e. teachers, supervisors and educational counsellors in special education, through conferences, workshops and seminars; and conducting courses on computer use in special education in the areas of learning cognition, independence, mobility, communication and potential employment as computer operators.

In a country such as Israel, with its small size and small population, a centralised project of this sort would allow the maximum of technology transfer to those who need it most. It would make it easier to provide services to persons when they are in school and are being prepared for adult living and potential employment.

*Special Education Department, Tel Aviv University*

At the Special Education Department of the School of Education at Tel Aviv University, three major projects have been carried out on "skills development through the application of computers for developmentally disabled adolescents and young adults". These projects deal with curricular and non-curricular areas. The curricular areas include use of computers for the development of abilities in writing and spelling and of pre-vocational skills that relate to speed and accuracyy of performance (in conjunction with the University of California in Santa Barbara, United States). The non-curricular area is that of training in social skills. A new project, unique to this programme, is home computing for disabled children, which has been facilitated through organisations of parent groups (see Margalit, 1990). The research, field work, teacher training and the workshops held have been reported in six papers (either published or in the press) dealing directly with the above-mentioned projects, as well as in several papers dealing indirectly with those projects.

## Access to technical information and consultation

Disabled persons and rehabilitation professionals must be able to get information and counselling about the use of technical aids. The technology of providing information of this sort can be considered as important as R & D into new technologies for disabled persons.

Following the pioneering work in this field in Sweden with the Handicap Institute, and in the United Kingdom with the Disabled Living Foundation, the Israeli Centre for Technical Aids, Building and Transportation for Disabled Persons (MILBAT) was established in 1981, during the International Year of Disabled Persons (see Rozin, 1987). When the Centre and its operation were planned, certain aims and principles were formulated:

(1) the Centre was to be independent and not part of any governmental agency, so as to be able to draw up its own policies;

(2) the element of competition among the various agencies, hospitals, rehabilitation centres and volunteer organisations was to be avoided;

(3) professionals were to be employed to run the Centre, with the aid of volunteers, and opportunities for counselling from professionals in various fields were to be created;

(4) it was to be made as simple as possible for the client to approach and receive services, by avoiding bureaucratic rules. The Centre was to be open to all without any need for referrals, and was to be flexible in responding to applications for information by personal visits, telephone or mail;

(5) balanced information was to be given to the client, but without any recommendations being made directly to the disabled person, lest these recommendations be used to pressure the agencies to finance these aids;

(6) research was to be encouraged in academic institutions and in industry to develop new aids and to improve existing ones;

(7) efforts would be made to standardise the various components in technical aids; and

(8) information was to be received from and exchanged with other centres around the world.

The Centre is located in Tel-Hashomer, with easy accessibility and parking facilities for disabled persons. It has a staff of five, including a director who is a wheelchair user, a secretary, an occupational therapist and a part-time speech therapist. Although further assistance is provided by volunteers, it is hampered by budgetary restraints and because it cannot increase its staff. It contains a permanent exhibition of all technical aids and devices dealing with activities of daily living that are available for purchase in Israel, as well as a library, documents and catalogues with information about technical aids or equipment existing in other countries. The Centre maintains links with the ABLE DATA network in the United States and has contacts with similar centres in Germany, Sweden and the United Kingdom.

Despite its small staff, the Centre does succeed in its primary aim of concentrating all information on activities of daily living for disabled persons, maintaining an exhibition of technical aids and equipment available for purchase in the country, and bringing institutions and agents up to date on new devices and equipment. It has helped to introduce new devices into the Israeli market, to educate professionals about the value of technical aids, and to encourage further developments in this field. Two notable steps have been the introduction of lightweight wheelchairs and incontinence pads in the country.

Apart from providing consultation to disabled persons and others about what is advisable or most suitable for a particular disabled person, the Centre also tries to assist in solving special problems.

Two small groups of professional volunteers, one in Haifa and one in the Tel Aviv area (which is connected with IBM), meet every fortnight to deal with special requests. They carry out house-visits if necessary and concentrate their minds on finding a solution to a particular problem. The speech therapist at the Centre has been particularly active in the field of alternative or argumentative communication, and was to present three papers at an international conference in this field in Stockholm in August 1990 (see Friedrich and Katz, n.d.). An internationally recognised American expert in this field spent some months working at the Centre, of which the highlight was a bar mitzvah reading through a voice synthesiser by a 13-year-old boy with severe cerebral palsy who was unable to speak.

The aim of the Centre is to reach out to all disabled persons in the country. However, the situation is unsatisfactory at present since it is estimated that, for lack of sufficient resources, fewer than 30 per cent of disabled persons know about the Centre and its aims. Visitors to the Center belong to the following categories: disabled persons themselves and family members; direct-care providers who visit through self-referral or referral by rehabilitation or social workers; students in all the helping professions – medicine, psychology, social work, special education, physiotherapy, occupational therapy, speech therapy; professionals working in various rehabilitation areas; professionals, especially in the younger age group, such as designers, architects, engineers, bio-engineers; and administrators of rehabilitation institutions and centres, and of homes for aged persons.

It is considered especially important to make students and young professionals aware of the value of technical aids, and that correct design and accessibility for disabled persons form part of the training of professionals involved to some degree or other with the future and advancement of disabled persons and their families. Telephone requests and correspondence are also dealt with. In the past year the Centre has held three combined conferences/exhibitions on the following subjects: mechanical wheelchairs; the use of portable laptop computers (it is especially important to reduce or overcome "computer problems" among disabled persons and professional workers); and adaptable kitchen cupboards which can be useful for persons in wheelchairs with various upper arm limitations, or with progressive muscular weakness that requires changes in the accessibility of equipment in the kitchen.

We may conclude this section by observing that technology transfer from researcher to manufacturer to marketer and finally to purchaser, and the proper use by the disabled person of a particular product, are as vital as the development of NT for disabled persons in various rehabilitation or bio-engineering research centres. MILBAT has indicated that information access technology can be carried out under modest conditions, with a limited budget and with the maximum use of dedicated professionals and volunteers. The Centre is located in the basement of a major hospital rehabilitation centre, with minimal expenses for rent, water, electricity and maintenance. Samples of equipment available for purchase have been donated by agents, making it possible to establish a permanent exhibition and to hold occasional temporary

exhibitions. Catalogues, articles and background material are often available at minimal or no cost. The caring, dynamic approach of the staff contributes towards the greatest possible use of the Centre and the provision of face-to-face consultation at no cost.

Despite the plethora of written material and computer data available on printouts, or the advertising material of various agencies, it is clear that nothing can replace or equal the value of a direct face-to-face meeting. Such consultation is objective and non-directive, and allows for opportunities to become acquainted with devices or aids before any decision is made.

It is our feeling that, in all developed countries, every catchment area of 3 million persons should have such a centre. In the developing countries, national or regional centres should also be established.

NT for disabled persons relating to employment, independent living, recreation, leisure and the quality of life will not have its greatest impact unless the technology of access to information and availability for consultation is equally developed.

## Technical aids

Persons whose activity is limited because of a disability can benefit considerably from technical aids, which can allow for more independence at home, greater access to work, and better opportunities at work. Many technical problems may be common to all members of a group with a particular type of disability, and solutions depend on the devotion and ingenuity of professionals, and on the ability to have a successful device manufactured, and sold at a reasonable price.

This section covers devices already in use and those still at the research stage, some involving high technology while others are based on low technology. The list does not claim to be comprehensive, but should provide a flavour of work done in this area in Israel.

### *Communication system for handicapped students*

An alternative communication system for disabled persons who are unable to speak or write (which is an adaptation of a system developed by IBM in the United States) has been developed at the Institute for Educational Technology in Tel Aviv. The system can be operated by finger or foot or by eyelid movements. It is based on choosing words which have been previously recorded and are voice-activated through a scanning procedure. The basic word dictionary can be complemented by adding words for more individual requirements, providing more flexibility. The system is at present in use with 14 students at eight special schools around the country and with eight adults. Continuing research includes investigating the possible use of the system with Bliss Symbols instead of words.

### *Restoration of hand function in persons with quadriplegia by electrical stimulation of muscles*

This research is being carried out by the director of the neuromuscular stimulation laboratory at the Neurological Rehabilitation Institute, Sheba Medical Center, Tel Hashomer, who is a bio-medical engineer. He has been working on three systems, using a microprocessor control; each system deals with a different level of spinal cord lesion: C.4 level (which is the most complex), C.5 level and C.6 level. The prototypes for use with persons with C.5 and C.6 levels are now undergoing home trials, and it is estimated that within a year the prototype for use by those with C.4 level lesions will also be ready for home trials.

The major purpose is to restore handgrip and thus allow persons with quadriplegia to carry out a number of functions that were previously not possible e.g. writing, eating, drinking, using cosmetics, etc. Similar research is being carried out in Japan, the United Kingdom and the United States, including exploration of the use of a neuromuscular implant.

As in many other areas, the transfer from the prototype to manufacture presents a major problem. It is estimated that there are about 25,000 persons in the world with C.4 lesions and about 500,000 persons with C.5 or C.6 lesions who could derive major benefit from using such devices.

### *Use of electrical stimulation for locomotion for persons with paraplegia*

Current research being carried out under the direction of the Dean of the Faculty of Electrical Engineering, Neuman Institute for Advanced Studies in Science and Technology, Technion, Haifa, is on designing a controller that will execute standing and simple locomotion on flat surfaces. The system uses surface electrons to stimulate the muscles that control posture and locomotion through functional electrical stimulation. Instead of using speed as a method of moving a limb, the command signal for walking is a fairly simple one and can be triggered by various means, among them hand-held switches. Activation through twisting the back is also being examined. It is uncertain when the research will be completed, and marketing questions will then call for major attention.

### *Nursing robot*

A nursing robot is being developed at the Faculty of Mechanical Engineering at the Technion in Haifa. The robotic arm has five degrees of freedom and should be capable of helping bedridden persons by opening windows and doors, carrying various objets, and operating households appliances.

*Communication system for blind persons*

Voltec in the town of Rishon-le-Zion is on the point of completing a communication system for blind persons which allows the transfer of written material from a blind person to others. A dictionary of 4,000 of the most common words (to which other words of especial use to the blind person can be added) has been fed into the computer programme through the use of the phonemes, and can be used through voice activation as a form of control, to print out letters or documents or memoranda for transmission to others. It is expected that the programme will shortly be available for sale (the approximate cost of the programme alone is US$1,200).

*Samson power drive*

This is the fifth wheel attachment, developed by Tzora Furniture Industries at Kibbutz Tzora, for manual wheelchairs, providing mobility and independence for wheelchair users and assistance for attendants. It is light in weight, adaptable to most wheelchairs, and easy to use. The fifth wheel and its electrical power unit, used when necessary, can enable the wheelchair user to overcome steep slopes, to mount kerbs up to 17 cm high, and to travel over difficult terrain such as sand or grass, without affecting the functioning of the wheelchair. It is less expensive and allows for more mobility as well as continual personal and active control of the wheelchair, as compared with electronically driven wheelchairs.

*Wheelchair car-top lift*

The GZ-91 is an automatic wheelchair storage and lifting device developed by Gottlieb-Zair Company, Bnei Brak. With one push of a button, the wheelchair is simply and safely raised for storage on the roof of the car or lowered for use. The wheelchair is attached to the arm of the GZ-91 by a simple connector. The entire procedure takes 30 seconds, and the device switches itself off automatically. During the operation of the GZ-91 neither the arm nor the wheelchair extend further out from the parked vehicle than the distance of the open door itself. The device has been in use in Israel and in other countries for a number of years and has been approved by governmental rehabilitation agencies.

*Clothing for disabled persons*

The Shenkar College of Textile Technology in Ramat Gan has taken an interest in the development of clothing and of devices that will allow disabled persons to be more independent and be dressed more comfortably. This is done by students in their final year, carrying out projects under the supervision of a senior lecturer at the College. Some of the arrangements developed include a brassière for a one-handed woman, a trouser-leg adaptation for a

person with an above-knee prosthesis, a canvas tray for use with a wheelchair for eating, working or writing which can be rolled up and taken along easily by the wheelchair user. An attempt is being made to set up a special centre for clothing for disabled persons at the College.

### *Do it (almost) yourself*

The director of the Scientific Services Department, Weizman Research Institute, Rehovot, and chairman of MILBAT, has devised and published a series of simple technical aids for disabled persons. They are easy to set up, inexpensive and designed to solve specific problems so as to make life easier for a disabled person. The series include the following:

*Car-leg support*, designed to avoid banging the leg of a paraplegic driver against the car door.

*Tube squeezer*. This device allows a person with upper limb amputation or with very limited strength in his hands or fingers to use toothpaste, soap, shampoo, ointment, or anything else that comes in a tube.

*Urine bag tap*. This involves the replacement of a standard tap by a rubber tube which is opened and closes by an eccentric, plastic handle-type tap which can be opened by a forward thrust of the wrist. This is helpful for persons who need to use a urine bag and who suffer from partial paralysis or impaired fine finger movement.

*Modified radio knobs* for use by persons with upper extremity amputation, partial paralysis or very poor fine finger movements who have difficulty in operating a radio with standard knobs.

*Book holder* specially designed to allow a bedridden person lying on his or her back to read for a long time.

*Electric razor switch replacement*. An external push-button, on-off switch is substituted for the small standard switch of an electric razor, for use by persons with upper extremity amputation or partial paralysis.

*"Octopus" remote switch*, which allows bedridden persons to operate various electrical appliances which are not within their reach.

*Door bell* for deaf persons, combining the buzzer mechanism of a door bell and a small electric light bulb.

*Typewriter platen knob* for a person with an upper limb prosthesis, which enables him or her to rotate the platen with the prosthesis to rewind a page when typing.

*Typewriter platen knob* for use by persons with partial upper limb paralysis or weakness of finger muscles.

*Spray-can activator* to enable a person with an upper limb prosthesis to use a spray-can by pressing a hinged metal strip.

*Distress signal for a disabled driver*. This includes a set of two alternately blinking lamps installed in the rear window of the car. On one lamp is the emblem of a disabled person and on the other is the printed message "Disabled Driver Needs Help". The lamps are operated from a switch on the dashboard.

### *Hayek oscillator*

This device, an external breathing aid that requires no tubes, is designed to assist people with respiratory disability, either temporary or permanent, to overcome breathing problems. The patient can strap on the device by himself, and if necessary, adjust its push-button controls with the help of a nurse. The oscillator consists of an electronically controlled airpump and a plastic cuirass weighing rather less than 1 kg that fits over the patient's chest and is attached to the pump. The inhale-exhale rate can be adjusted to suit the needs of persons with respiratory disability at any age. As compared with a normal respiratory rate of 10-20 breaths per minute, the Hayek oscillator can reach a frequency of up to 1,000 cycles a minute with no ill effects and to the patient's benefit. Although at present it is marketed only for hospitals, it is hoped that it will soon be available for use at home, in clinics or in workplaces.

In countries where there are no government-supported rehabilitation engineering or design research centres, much of the research is carried out under struggling and often inadequate conditions. More investment in R & D would not only be helpful for disabled persons, but would also provide a source for employment, revenue and export, especially when the local market is as limited as in a small country such as Israel. Regional cooperation and joint binational ventures may also be one of the ways to overcome such problems.

Nearly all developments of technical aids in Israel, and probably in many other countries, also suffer from manufacturers' reluctance to invest in manufacturing new products, and from difficulties in marketing and in locating potential customers. A central marketing agency in Europe, and another in North America, would help to solve such problems, and thus allow for new technological advances to beecome available to the disabled person as a consumer. Somehow a balance must be established between the expenditure of millions of dollars on reserch in various centres and the lack of opportunity for a disabled person, as a consumer, to use a new and advanced product: since it is for the benefit of the disabled person that all the research is being carried out.

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# Part IV. Placement and employment of disabled persons trained in new technologies

# 9

## New technologies and the employment of disabled persons in four developed countries

*Jacques Dawans*[1]

This chapter introduces the programme of the IBM European Support Center for Persons with Disabilities (IBM ESCPD) in La Hulpe (Belgium). This relatively recent programme is designed to bring information technology to the attention of disabled people. There follows a description of IBM-supported projects on the placement and employment of disabled persons in Denmark, Italy, the United Kingdom and the United States. These four programmes reflect local initiatives in the host countries as well as the company's commitment to "People Helping People Through Technology".

For many years, several IBM national organisations in Europe have been supporting the disabled community. On the basis of this experience, and because personal computers (PCs) can greatly help disabled people in many ways, it was decided in 1988 to implement a structured programme within the EMEA (Europe, Middle East and Africa) organisation of IBM, known as the European programme to support persons with disabilities and to promote their employment. This programme has three main objectives:

(1) to make information technology available to disabled people by demonstrating to them how technology can help them at home, at school and in the office. Many disabled persons are still not aware of what information technology can do for them, and awareness is very often the first step to solving the problem; and

(2) to promote the employment of disabled persons. Disabled persons *can* perform productive work. Employing disabled people with the help of technology very often enables them to perform intellectual jobs and therefore to achieve higher productivity. Several surveys have shown that it makes good business sense to employ disabled people. Usually, their willingness to work hard and their loyalty to their employer are exemplary; and

(3) to help customers who wish to employ, or who have to employ, disabled persons. More than 70 per cent of disabled people became disabled because of accident or illness. Employers are, or soon will be, faced with

[1] IBM European Support Center for Persons with Disabilities, La Hulpe, Belgium.

the problem that some of their employees may become disabled. Moreover, in some countries employers are required by law to employ a given percentage of disabled persons. Other companies wish to employ disabled persons because they want to show their goodwill to the community in which they are living.

Thus far, IBM has taken four steps to implement its European programme. First, an advisory board for action in favour of the disabled community was set up in its European headquarters in Paris. The board meets every quarter to review past actions and to give guidance for the future.

Second, managers were nominated to take charge of this programme in 20 countries in IBM's EMEA organisation, and nine national support centres or joint projects with existing institutions were set up; it was planned to open two additional national centres during the first half of 1990.

Third, the European Support Center in La Hulpe, near Brussels, was established. Its mission is to drive and coordinate the programme and to organise the exchange of information between countries. The European Support Center is also responsible for ensuring liaison and exchanging information with a similar centre located in Atlanta, Georgia (United States) and with the Special Needs Systems Group in Boca Raton, Florida (United States). The mission of the Special Needs Systems Group reads as follows: "Enhance the quality of life and employability of persons with disabilities through the use of IBM value-added technology." Two of its technology products for the disabled have already been announced in Europe: the Screen Reader for blind people and the Speechviewer for deaf and speech-impaired persons.

Fourth, in most countries a substantial price discount was granted on the PS/2 product line for disabled people and for non-profit-making institutions supporting the disabled community. Each country is implementing projects in cooperation with institutions supporting disabled people and involving the business community. A database of aids and tools is maintained at the European Support Center in La Hulpe, which contains some 300 OEM/IBM products that can work with the company's PC or PS/2s. Ideas and experience on specific projects are continuously exchanged between the European countries and the United States and Canada. "For most people technology makes things easier; for a disabled person, it makes things possible."

## The placement and employment of disabled persons

### *Training and job placement for blind and visually impaired people (Denmark)*

Until now blind and visually impaired persons have been employed in Denmark mostly within the public sector, e.g. as switchboard operators. The

Government has, however, said that these opportunities will be limited in the future and that employment should be found within the private sector for such persons. In 1985 the Institute for the Blind and Visually Impaired and IBM Denmark came forward with the idea of the DAUS project (DAUS is the abbreviation of the Danish for "Implementation of the computer in the education of blind and visually impaired persons"). Until then, computers had scarcely even been used by people with these disabilities.

### *DAUS – Phase I (1986-88)*

Courses on simple text processing and the use of computers were introduced. Blind switchboard operators started using computers as a tool to find extension numbers and to receive and transmit messages. Computers also replaced traditional typewriters as a training tool. The Institute for the Blind and Visually Impaired trained some 45 persons in this basic Administration/Switchboard Operator School. Because no good Danish speech synthesiser was available, IBM, with the help of Tele Research Lab (for the hardware) and the Fonetics Institute (for the software), set up a project to develop a satisfactory one.

### *DAUS – Phase II (1989-91)*

At the end of 1988 the Phase II project was sent to the Danish Ministry of Social Affairs with a request for financial support from the EEC, which approved the project and provided funding. The DAUS II project is funded by the EEC, IBM and the Institute for the Blind and Visually Impaired and is supported by the Danish Employers' Confederation. The idea is to offer EDP courses to blind and visually impaired persons who previously held non-EDP jobs but have become unemployed. After completing the course, the project group is to help them to find EDP-related jobs within the private sector.

The courses range from text and database handling, archive and spreadsheet functions and system administration to the use of computers in the education of music teachers and composers. The project consists of four parts:

(1) testing of technical EDP solutions; much testing is necessary to select the best peripheral equipment, such as scanners, screen readers, special keyboards, Braille lines and printers, etc. Four personal computers are used for this activity;

(2) education: a ten-week training course on the use of information technology has been set up. The first course started on 1 March 1990 and is attended by six blind or visually impaired persons. Eleven computers are used for this activity;

(3) industry panel: this panel is composed of representatives from various large employers belonging to the Danish Employers' Confederation.

Their mission is to identify job opportunities, contact member companies and try to get job openings for the blind candidates; and

(4) music: computers have also been used for the education of blind organists, choir leaders, composers, etc. Input and output is possible both with Braille and by using an ordinary keyboard and printer. The project also includes the possibility of musical input, playback and output via a special keyboard (MIDI). This has opened new job areas for blind persons. Two computers at the facility are used for this activity.

The objective of the DAUS project is to find ten to 15 jobs for blind people by the end of the project. The challenge is to overcome the psychological barriers on both sides: first, to convince blind persons that there are new job opportunities for them: to do this requires an increase in their self-confidence and in their business knowledge; and second, to convince employers that blind persons can do the job and be productive, which means giving examples and getting more public attention. As soon as the first six candidates have found a job, the plan is to have the story on television.

## *Information technology training and placement for disabled people (Italy)*

This project was implemented by the Association for the Professional Development of Disabled Persons in Information Technology (ASPHI). In 1977 IBM Italy hired two system programmers who were blind and, two years later, in collaboration with the Francesco Cavazza Institute for Blind People in Bologna, organised the first training course for blind system programmers. In 1979 the Italian Government, with the help of the Cavazza Institute and IBM Italy, created a list of blind programmers to make it easier to place the students from this programme. In 1980 the companies that hired the first 16 students created ASPHI, which continued cooperating with the Cavazza Institute and, in 1984, in collaboration with Fondazione Pro Juventute Don Carlo Gnocchi in Milan, expanded its activities to include organising courses for hearing impaired and physically handicapped system programmers.

At the time of writing, ten courses for blind people and six for physically handicapped or deaf persons had been organised; in all, 176 persons had graduated from these courses. ASPHI also tries, in collaboration with the previously mentioned institutes, to find jobs for the students. Today 148 graduates are employed, i.e. over 84 per cent of the total.

ASPHI also contributes to some special projects designed to improve disabled persons' prospects of obtaining information technology jobs, e.g. communication software for a Braille line and for a voice synthesiser (in cooperation with the National Council for Research); didactic software for blind children (in cooperation with the City Council of Bologna and some primary schools in Bologna); and didactic software for children with communication problems (in cooperation with the district of Emilia Romagna).

IBM Italy contributes to ASPHI activities by lending employees and machines, as do other Italian companies, e.g. SIP (the Italian telephone company) and NOMISMA (Economical Studies Society). Up to 75 per cent of didactic modules are created by instructors who work for member companies of ASPHI. Many employers also help in the effort to find jobs for students when they complete their training.

*Training*

To attend one of these courses, candidates must pass an aptitude test devised by IBM Italy and be interviewed by an interdisciplinary group of experts. The training course lasts nine months. Before their final exam, the students present the results of their case studies to a group of data-processing experts, who also happen to be potential employers.

*Personal cases*

The following cases illustrate the types of contribution made by disabled people in Italy. The contributions of ASPHI and the individual employers are noteworthy, but most of the credit goes to the talented individuals who have taken the opportunity to show what they can do. IBM Italy is very pleased with the results of these programmes.

Giuseppe Roccasanta is a young tetraplegic who became an accountant in 1980. When the Labour Office presented him to a company for an interview, the company rejected him. The District Medical Committee classified him as completely disabled (100 per cent) and therefore unable to work. The young man did not accept the Committee's decision, and said so. He then attended a course for system programmers. The District Medical Committee called him again to review his situation, and owing to his outstanding training decided to set his disability at 75 per cent. One of the persons on the committee said, "If another company rejects you, you will be 100 per cent disabled, and for ever." This occurred in 1981 (the United Nations International Year of Disabled Persons). Following this unpleasant experience, he was hired by an insurance company as a system programmer. He is still working for that company, to the satisfaction of the company and himself; he is now vice head-clerk.

As a young man, Vincenzo Ranucci was involved in a vehicle crash, resulting in total paralysis of his legs. He attended a system programmer course, but when a bank offered him a job, he refused it because he thought that he was not able to hold down a full-time job. So he obtained a PC and started to write programmes for a software house, working at home. Now he is a very good programmer, working for several software houses as a successful self-employed individual.

Pacifico Mangini is totally blind. He is working for the IBM branch office in Genoa, in customer support. He has given system programming support to customers in all regions of Italy. He reaches those customers by himself, despite his handicap. Some customers refused to have him when IBM

told them that their system programmer was blind. The branch office manager handled this by saying that customers would not have to pay for the system programmer until they recognised his productivity and professionalism. This has always happened on the first day of his work. If customers who already know him need other jobs from IBM now, they will ask for "that blind person".

Francesco Levantini became blind at the age of 14, but continued to study and obtained a degree in philosophy. Then he attended a system programmer course, with excellent results. Employed by IBM Italy, he became a system programmer expert in artificial intelligence. For an IBM application relating to the automation of information systems internal to the company, he received a special award of US$12,000. He became an instructor in courses on expert systems and now he is a very valuable employee working in the marketing department.

## *Employment of disabled people in a manufacturing plant producing information technology-based products (United Kingdom)*

Greenock is a town on the Clyde coast some 25 miles west of Glasgow. IBM Greenock started its manufacturing operations in 1951 with typewriter assembly and today, with 2,500 employees, it is the company's high-volume plant in Europe for display systems, keyboards and the full range of its PCs.

The following sections indicate what has been done at Greenock for the employment of disabled persons.

### *Adaptations and changes in either career or equipment*

IBM has a full employment policy which includes those who become disabled during their period of employment with the company. Every effort is made to modify the job, equipment, facilities (such as access routes, toilet facilities, emergency procedures), etc., to accommodate the needs of any employee who becomes disabled. Examples of such changes are:

(1) a male employee who worked on the assembly line and whose sight began to fail was offered a position in the telephone exchange and provided with an item of equipment which magnified the directory listing, thus enabling him to remain in employment and perform a significan job within an office environment;

(2) a deaf employee who worked as a toolmaker was given the opportunity to take a two-year training course; this would permit him to become an engineering professional who would design tooling using CADAM (Computer aided Design and Manufacture) and liaise with vendors for manufacture and supply;

(3) a woman who prepared food for the plant cafeteria and whose eyesight began to fail, preventing her from performing her duties safely, was retrained to conduct a "help desk" activity. This meant she had to answer telephone calls reporting faults in equipment and facilities. She records the faults on a specially adapted PC with enlarged nomenclature keytops and magnified characters on the VDU. She also schedules and monitors the progress of fault rectification through to conclusion;

(4) a group of deaf employees have regularly scheduled meetings, with a sign-language interpreter present, to ensure that communication is effective. This group is currently being issued with vibratory pagers which should assist with emergency evacuation procedures and provide a means of contact during an emergency; and

(5) toilet and access routes throughout the site have been upgraded to permit easier access for physically disabled staff and visitors.

*Youth Training Scheme*

It is intended to place disabled youngsters in the United Kingdom Government training scheme for young people. The objective is to fill 10 per cent of the placements with disabled young people, and the internal training has been designed to meet the needs of various disabilities. The training is divided between administration and manufacturing operations, with all the trainees spending at least 20 per cent of their training on further education.

Internal training is focused on, for example, keyboard manufacturing techniques, surface-mounted technology manufacturing, early-entry system work on personal computer and personal system manufacturing, site services activities, accountancy techniques, material logistics, and office systems within support areas. Residential centres are used to enhance personal development, and this opportunity is given to all trainees.

In addition, training has been given via local external facilities for people with special needs, where appropriate programmes have been developed. An example of this would be young people with learning difficulties, for whom special arrangements would be made at colleges for further education.

*Complementary workforce*

The limited permanent hiring programmes of the last few years, and the opportunity of having people take temporary jobs with IBM in times of high unemployment, are reasons why IBM has planned to recruit at least 3 per cent of registered disabled people in any recruitment drive. The entire management team and staff has supported this project, enabling disabled people to be trained and made able to satisfy high standards of workmanship and quality.

### *Sheltered workshop activity*

IBM Greenock has had a long and happy relationship with Haven Products, a subsidiary of the British Red Cross Society. Haven Products now has a sheltered workshop in Greenock. Until 1989, Haven Products was located some 13 miles from the plant.

The workshop is staffed by over 40 severely disabled persons on a 9 to 5 basis, five days per week, unlike IBM Greenock where various shifts are in operation. Scheduling of work is therefore very important to ensure the smooth transition of subassemblies into finished products in a timely manner. IBM provides continuing employment, together with tooling and work instructions, for approximately 40 disabled people. In revenue terms this equates to approximately £1 million per annum. The type of work varies from simple segregation and packing operations through the programming of electronic components to the purchase and supply of components and assembly of completed subassemblies. In 1987 Haven Products was selected for an award because it was among the top ten quality suppliers to the IBM Greenock plant.

### *Involvement with disabled agencies*

IBM Greenock is actively involved within the local community with disabled agencies via support from both management and staff. Among the groups who benefit from such efforts is the Committee for the Employment of Disabled People (CEDP) which is run by the United Kingdom Department of Employment. The CEDP reviews employment opportunities for disabled people within the area, and also addresses items which will be of benefit to disabled people. Another major forum is REMAP, a management group which seeks rehabilitation opportunities via the adaptation of equipment and facilities. Both the CEDP and REMAP are supported by IBM management within the site.

Other groups who benefit from such commitments are the Society for the Deaf, the Talking Newspaper for the Blind, the Dyslexic Association, and the Royal National Institute for the Deaf where a member of the National Committee is an engineer at the plant. Support to such organisations is seen in the community as a strong link to a wider group of disabled people.

### *Plant recognition*

IBM Greenock is proud of its record relating to the safety of its employees, for which it has received various safety awards. Such a record has enhanced its employment of disabled people, and together with its work record has resulted in IBM Greenock being the first company in the United Kingdom to be awarded the Fit for Work Award from the Department of Employment for the third time in succession.

## *Computer programmer training for severely physically disabled people (United States)*

The IBM Programme to Train Disabled Persons currently has two major programmes: Computer Programmer Training for Severely Disabled Persons (CPT), and Personal Computer-Based Skills Training for Disabled Persons (PST).

CPT was initiated in 1972 as a result of a suggestion by a disabled IBM employee, who believed that the advent of computer technology had created opportunities for disabled persons which had not been previously available, and that IBM should lead in helping these persons to benefit from these opportunities. Investigations showed that computer programming provided an ideal opportunity for disabled persons to take up information processing.

The requirements to succeed as a computer programmer were intellectual and not physical. Thus, physical limitations would not necessarily affect the students' ability to succeed in computer programming. There also was a great need for computer programmers at that time, and programming careers provided excellent starting salaries and advancement potential. The high salaries were important for a disabled person who would most probably lose valuable medical benefits fairly soon after being employed.

For the first 15 years of this initiative IBM provided personnel at no cost ot assist the local rehabilitation/training agencies in implementing their individual projects. A significant addition to the programme began in 1987, when the company began providing the classroom data-processing equipment required for training.

By about the same time the PC had made significant inroads into the business world and had become the chosen terminal for performing many tasks that previously had been mainly done manually (or had to be performed on a mainframe computer). More people trained to work on PCs were needed in such skills as word processing, computer-assisted drafting, computer-assisted design, customer service representative, data entry, and personal computer expert. Although training was needed for these jobs, the requirements were not so demanding as those for computer programming. In addition, since a large mainframe computer was no longer necessary, it was now possible to provide such training at reasonable cost for small numbers of disabled people. The Programme to Train Disabled Persons was consequently expanded by adding a second element, Personal Computer-Based Skills Training for Disabled Persons (PST), under which the training opportunities available to disabled persons were broadened and additional opportunities provided for students who could not qualify for or complete the CPT course. IBM provides the PCs required for training as well as some limited aid from the IBM Programme Office Staff Consultant. Primary responsibility for the project remains with the assigned IBM consultant.

The main difference in the process of developing a project under the CPT initiative and the PST initiative is in the level of involvement of the IBM

consultant and the nature of the training being provided. Another major difference is that the CPT projects are producing professional-level graduates who must compete with college graduates for jobs, whereas PST projects are providing graduates with PC skills that will allow them to compete for jobs with other graduates of similar public and private training programmes. An obstacle facing graduates from both types of project is that employers need to understand that the graduates are able to perform the job and that there is no risk in hiring a disabled person.

Through the CPT and PST projects IBM has assisted in the development of 40 current training projects spread throughout the United States. Qualifications for entry into the CPT projects vary somewhat, but usually students have to have a high-school diploma or its equivalent, above-average intelligence, 12th-grade reading comprehension, and an aptitude for computer programming. The entry requirements for PST projects vary according to their location and the skills being taught (e.g. computer operations, customer service representative, data entry, PC specialist, word processing, business office skills). In addition, students in all the training projects should be mentally and physically stable and have accepted the reality of their disabilities. All students in these projects are certified as disabled by the respective state vocational rehabilitation agencies.

The projects have been very successful, having placed 2,587 out of 3,069 CPT graduates (84 per cent) in programming positions up to December 1989. The average salary for these placements in 1989 was approximately US$20,800. In addition to the CPT graduates and placements, 477 disabled persons successfully completed training in PST skills, of whom 388 (81 per cent) have obtained employment. The graduates of these programmes have entered a constantly growing, high-technology field with a virtually limitless future.

## Conclusion

Other programmes could be described as well, but the above accounts should provide a feel for IBM activities to support the employment of disabled persons around the world. IBM is committed at the corporate level and at the local plant level to make information technology available to disabled people with the object of giving them the opportunity in an active life at home, at school and in their profession.

The company believes that information technology can play a critical role in overcoming the physical limitations that have prevented the employment of many disabled persons. As a manufacturer of such technology, IBM seeks to find ways to make disabled persons more productive with new technologies and ways to make new technologies more productive for disabled persons.

# 10

## New technology in rehabilitation: A Hungarian perspective

*György Konczei*[1]

During the past few years, the subject of new technologies (NT) has been examined in several highly developed countries, including Belgium, Japan, the Netherlands, Sweden, the United Kingdom and the United States, under a project conducted by Rehabilitation International and sponsored by the ILO. In the second phase of the project, it was decided to include Hungary, although it was recognised that NT had not made significant progress in that country. None the less, it was felt that the Hungarian experience, limited though it might be, would illustrate the process of adapting NT to the problems of disabled persons in a country where the economy is only now emerging to take its place among those of the more developed countries.

It is as well to note that, in many different ways, the connection between technology and disability can be traced back many years. Jerome David Tuckett, a well-known British economic historian of the nineteenth century, published his book *History and the past and present state of labouring population* in 1846, and this was used as a basic source by Karl Marx when he wrote *Das Kapital*. Tuckett cites the example of a manufacturing plant in England in the 1690s where mentally retarded persons were employed on routine operations. But the purpose of their employment was not to advance the rehabilitation of these persons but to guard the manufacturing secrets. As he put it, "... people with mental imbecility... ignorant and stupid persons were employed ... in order to save the secret technology of the manufacture (Tuckett, 1846, p. 148). This hardly fits today's rehabilitation model, in which NT is looked upon as a way of promoting the employment of disabled persons. It is not a matter of disabled persons for technology but of technology for disabled persons.

In Hungary, and probably in most other Eastern European countries (although this situation is rapidly changing), we have to enlarge the concept of NT so as to include data processing and other types of employment which might be considered to be low technology in some of the more advanced countries. This is especially true as regards the application of NT to the employment of disabled persons. The inclusion of Hungary, or probably any other Eastern

[1] Budapest University of Economic Sciences. The author is indebted to Mrs. Zsuzsa Winter (Ministry of Public Welfare), Mr. Andras Arato (BRAILAB), Lajos Kullmann, M.D. (Hungarian Society for Rehabilitation), Mr. Oszkar Wettstein (RODATA) and Mr. Geza Sipos (QUADRO BYTE) for their generous help and fruitful consultations.

European country, in this project requires first of all a change in the basic concept. We cannot use "new technology" in its "absolute" meaning, but must be satisfied with a relative or comparative meaning of the term, adjusted to the stage of development of the country. The computer revolution, microelectronics, even biotechnology, have yet to come to Hungary, and we must define the problem at the level of Hungarian economic development.

Another problem goes hand in hand with the first problem. Not only has Hungary (or Central and Eastern Europe) lagged behind in to the development of NT but also a modern way of handling disability has not yet been developed. The disability rights movement has not made significant progress and there is a long way to go before physical and attitudinal barriers are broken down. Unfortunately, a disabled may still be considered to be a second-class citizen typically working in a low-prestige job. Jobs such as porter, bell-hop, night-watchman, charwoman or envelope-folder may be the only employment opportunities available. These are typically low-skilled jobs for which little training is required. Yet, as will be pointed out, there have been examples of disabled persons organising themselves to gain access to higher-skilled jobs with the aid of the computer and ancillary equipment. We first examine briefly some of the main points of the Hungarian experience with rehabilitation.

## Some fundamental characteristics of the Hungarian vocational rehabilitation system

### *The economic background*

Although, following the years of socialism, the outlines of radical market reform can now be seen in Hungary and will probably lead to a much better economic structure in the future, the results so far have been a rapid increase in the rate of inflation (from 6 to 30 per cent) and a concomitant rise in unemployment (from 0 to 6 per cent). This has not helped the employment of disabled persons, and thousands have been excluded from the labour market. (Although during the socialist era no visible unemployment appeared in the statistics, hidden unemployment existed as workers were employed on tasks that added little to the social product.)

The present situation as regards vocational rehabilitation is affected by another important economic fact. The general level of wages during the socialist era was so low in real terms that families required more than one wage earner to maintain an acceptable standard of living. For this reason (and for other reasons as well, since the trend was not confined to Eastern Europe), an increasing number of women entered the labour market. The cost of labour, although it had risen as part of the long-term secular trend, remained low. When a worker became disabled, the company could easily find a replacement from amongst the non-disabled population. Given the state of the labour

market and the absence of any rules or laws governing the rights of disabled persons, the employment outlook for disabled people remained grim. Little effort was made to train or retrain them, and they were placed in the lowest-paid and the lowest-prestige jobs, which few persons wanted.

The current period of privatisation is inevitably a difficult one, as state subsidies are removed and enterprises are forced to operate in a market economy. In time the economy will adjust, but at present the prospects for the use of NT and the employment of disabled persons are not bright. Any NT equipment in Hungary has probably been imported, since at present the production of NT in Hungary itself may not be cost-effective. At least, this would seem to be true if the country has to develop NT on its own. But it is likely that, as the present priorities given to instant profits are modified, a new kind of entrepreneur will appear who may be able to take advantage of the production methods used abroad. When new manufacturing and service industries are contemplated, it may be that NT will be imported quite naturally as part of the production process.

Nevertheless, we must conclude that the current method of doing business and the short-term prospects are not very favourable for the employment of disabled people.

We do not have exact data on the unemployment rate of the disabled population but it may be estimated at least six to ten times higher than that of non-disabled persons. This high rate of unemployment has clearly affected the development of policies in the area of rehabilitation.

## *Rehabilitation: A network of counter-forces*

In the 1990 state budget 3,050 million forints (about US$600 million) are allocated for vocational rehabilitation. Of this amount, some 50 million forints come from the so-called REHAB FUND, which is made up of amounts paid by firms under the quota and levy system. In factories and certain other establishments disabled people are supposed to account for up to 3 per cent of the total labour force. Enterprises which fail to meet their quotas are obliged to pay a levy, which goes into the REHAB FUND. These 50 million forints are used to support different programmes or create new jobs for special groups of disabled people. The other 3,000 million forints are used to stimulate the employment of disabled persons in companies, but not to underwrite specific state programmes.

Companies employing disabled persons can receive wage subsidies up to 50 per cent of the wages paid. Certain special companies, in effect providing sheltered employment, can be subsidised by over 100 per cent of wages in some cases. An example of one such enterprise (RODATA) is presented in the following section.

Decisions about the level of subsidy are made by the Ministry of Finance. There have been few evaluations of these subsidies, and little attention has been paid to their cost-effectiveness. The system works on an

extremely low level, and vocational rehabilitation can be compared to a "bottomless pit" from an economic point of view.

Unfortunately, data about the number of impaired and disabled people in Hungary are sparse. The best estimates quote a figure of 10 per cent, which means that every tenth person has an impairment, disability or handicap. As the population of Hungary is 10 million, there may be as many as 1 million disabled persons.

Under the relevant legal provisions, persons can be classified as handicapped and receive a disability (handicap) pension if they have lost at least 67 per cent of their working capacity. Approximately 500,000 people are receiving such pensions, of whom 200,000 are of working age (below 55 for women and 60 for men). The number of disabled persons whose lost working capacity is between 15 and 66 per cent must be at least 500,000.

Most of the disabled and handicapped people are blue-collar workers with low levels of education (see table). Other data confirm that handicaps and disability are typical problems of low-skilled, poorly educated persons, who are at a disadvantage in Hungarian society. These are persons with few assets and little real property. (This finding is not atypical of other countries; see, for example, the case of Norway: Gogstad, 1968, pp. 120, 138-139.) Only one-quarter of the households with a disabled family member are able to save a certain amount of money a month (see Konczei, 1987, p. 91).

## *Vocational rehabilitation*

A great deal of the vocational rehabilitation that does take place makes use of sheltered employment. Many persons employed in these shops receive a temporary or regular social (disability) allowance. The amount of productive work in these shops tends to be low, and it has been said that they formed part of the hidden unemployment in the economy during the communist regime. The following sheltered workshops exist at present:

(1) nine protected workplaces, which employ about 750 employees, 500 of them in closed institutions (1988 data). These shops are financed and run by the founding employer, companies or factories.

(2) 35 social vocational workplaces run by city councils and employing 2,300 disabled persons. These shops contract for piece-rate work. The are self-financed for the most part, since they generate income from the work done, but they are also funded by local councils with some support from the central Government;

(3) seven specialised social homes with about 5,000 disabled employees (1989), funded partly by local (county) councils and by the central budget of the State; and

(4) 30 special companies for vocational rehabilitation with some 6,000 disabled employees, established with local resources but financed

**Table. Disabled and handicapped people in Hungary by job and level of education, 1983 (percentages)**

| Job | % | Education | % |
|---|---|---|---|
| Intellectual occupation | 12 | University (college) | 3 |
| Skilled labour | 31 | High school | 10 |
| Semi-skilled labour | 22 | Training of skilled workers | 17 |
| Unskilled labour | 18 | Primary school | 39 |
| Other manual workers | 17 | Below primary school | 31 |
| Total | 100 | | 100 |

Source: Konczei, 1987, pp. 76-79.

through direct or indirect state support, partly in the form of a reduction of the profit tax (normally 50 per cent, but in the cases of social vocational workplaces only 10 per cent) and direct subsidies of disabled employees' wages. In some cases these subsidies can be between 70 and 450 per cent. In 1989 they amounted to 780 million forints for the wages of the 3,500 rehabilitated workers in this sector. These sheltered workshops provided a total of approximately 14,000 workplaces: it is estimated that this is only 30 per cent of the 45,000 that are needed (Winter, 1990).

Unfortunately, we do not have much information about vocational rehabilitation in normal workplaces. Activities appear to be sparse and persons who become disabled tend to opt for pensions instead of any attempts at rehabilitation. Moreover, plant managers find little difficulty in replacing workers who become disabled. There seems to be no change in these attitudes or actions in the case of the newly established enterprises.

Let us compare the typical rehabilitation system in a developed country (figure 1) and in Hungary (figure 2). The modern process of vocational rehabilitation consists of many steps. But, as illustrated in figure 2, there are very few rehabilitation services in Hungary, and where they do exist they tend to be underused.

## Examples of NT in rehabilitation

One positive new example of NT use is the photocomposition unit of the ALFA Company, which is owned by the Hungarian Federation of Physically Disabled People. There are 35 people in this unit, 25 of them severely disabled. The unit has 35 special computers with Hungarian-made software and operates in the rapidly growing publishing market in Budapest. Our main examples here, however, will be of RODATA and QUADRO BYTE.

**Figure 1. The rehabilitation process in a developed country**

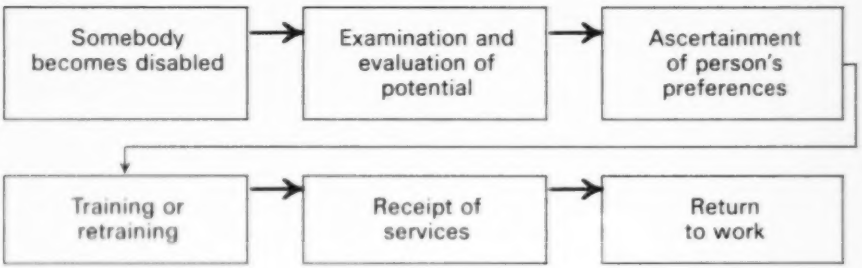
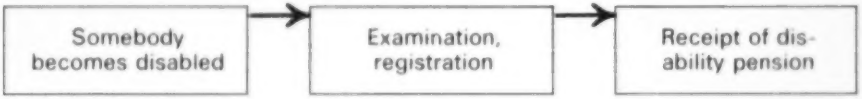



**Figure 2. The rehabilitation process in Hungary**




*RODATA*

Severely disabled people living with motor or other serious physical disorders and using wheelchairs tend to live in closed institutions. This institutional life does not offer a great deal of freedom, and there are few opportunities for rehabilitation. Alcoholism and drug abuse are widespread. The independent living movement has not made much headway, with the first scientific publication on the subject appearing only in 1987.

There are two large institutions where physically disabled persons can live. Persons who do not live with their parents or in old people's homes tend to live in one or other of these places.

The basic idea of founding RODATA came from a leader of the ROZMARING Co-operative in 1981, the International Year of Disabled Persons. The aim was to help people living in institutions to obtain total independence. He later became the director of RODATA. He was discouraged from starting the enterprise and was told in the beginning, that it would be impossible to do anything with those people "who do not even know the price of a pound of bacon". According to the original plan, some professionals, mainly economists, wanted to found a special housing estate for wheelchair users. This can be very important in a society where a person in a wheelchair is in effect not accepted. These people are unable to move or travel in the streets as there are no special ramps, and they are unable to get into a building or to use a toilet.

The first step was to form a housing cooperative with 54 disabled people who had the personal and psychological ability to live independently. Each was a young wheelchair user, disabled because of muscular weakness as a

consequence of contracting Heine-Medin disease in childhood. They had to pay 50,000 forints in order to become a member of the housing cooperative. At that time, US$1 was worth 40 Hungarian forints, so the sum was quite high for a severely disabled person in the usual income and social position.

In the case of two persons who had problems in raising the funds, the parent company, ROZMARING, paid the money. Even with all the money paid in, however, 54 × 50,000 forints would not have been enough for the initial capital requirements. To supplement these funds, the Association of Communist Youth and the Ministry of Finance raised a special fund. The 54 people joining received an extra 340,000 forints of preferential and advantageous credit for 35 years at 1 per cent interest.

The site for the enterprise was given by the City Council of Budapest, free of charge. Most of the single-floor houses, a little less than 60 $m^2$ each, were ready in 1983, but the last one was completed in 1985. There were 54 inhabitants at the beginning, but most of them are married today, and 16 children now live on the estate. A playground was recently built for them.

RODATA is the only undertaking of its kind in Hungary. It is unique in that people were brought out of closed institutions, to form an enterprise where people live not far from each other and work at the same place near their homes.

In order to raise the necessary funds from the Association of Communist Youth and the Ministry of Finance, the director had to be a good organiser and a good lobbyist. He was also instrumental in formulating the guiding philosophy of RODATA. It was his idea that wages should be paid only for real work. This programme was difficult for many disabled people to accept after many years of not having had the opportunity to participate in productive work. Although set forth as the ideal, this principle has not always been realised in the everyday work of the firm.

According to its critics (some of whom live in the territory of the housing estate: see, for example, Garbacz, 1987), the segregated colony resembles a ghetto, although it does form an intrinsic part of its wider environment. However, this disadvantage must inevitably be compared with the only alternative, institutionalisation.

The company has also bought a special air-conditioned hydraulic bus with a video recorder and a built-in toilet, the only one in Hungary.

RODATA's principal activity is to do with data processing. A separate building on the housing estate was set aside for these activities. The company receives data from customers, processes them and sends them back. The customers are largely good-sized firms which are unable to process in their own organisation the huge quantity of vouchers, testimonials or certificates they receive. The customers give these commissions to RODATA because the company is able to offer relatively low prices, owing to the indirect and direct financial support given by the State.

A centralised data processing system known as Videoplex was developed, based on an old computer and 16 terminals. The installation can accommodate 16 people at a time with four extra people backing up. As two shifts are

operated, a total of 40 persons are employed. Supplemented with other complementary jobs, most of the inhabitants are able to work in the housing estate. Many of the employees have already had one or more jobs, but most of them have never dealt with data processing before. This did not prove to be a great obstacle, as most persons learnt the basic skills in a short time. Some employees periodically take a refresher course in computer programming to keep up to date.

Their job (data processing, word processing, programming) has proved to be not too complicated; indeed, it can be monotonous at times. However, very few people have left the company since it started up in 1985. Possibly the most highly educated person (the mathematical programmer) left for a better job a year ago. He founded QUADRO BYTE Computer Service Ltd. Co. (see below) as a new enterprise.

Of every 100 forints paid to the employees, all Hungarian firms have to pay 43 forints to the State as a social security contribution. However, as a special company for vocational rehabilitation, RODATA can claim back 130 per cent of the wages paid to disabled employees. Most of the employees receive a disability (handicap) pension of approximately 5,000-6,000 forints. Working in RODATA enables the employee to earn another 6,000-10,000 forints.

The company has another source of (indirect) support, i.e. the profit tax. A normal company has to pay 50 per cent of its profit as profit tax to the State. RODATA pays only 10 per cent. The company's return from sales was 22,475,000 forints, and it received exactly 4.8 million forints (21 per cent) as a subsidy in 1989, about half as much as the national average of the 30 special companies concerned with vocational rehabilitation. The subsidy allotted to one disabled employee of RODATA was 124,191 forints in 1989.

The total subsidies received by RODATA between 1986 and 1989 were as follows: 2,062 million forints (1986); 2,409 million forints (1987); 3,304 million forints (1988); and 4,800 million forints (1989). The big increase between 1988 and 1989 was because the so-called social security allowance was introduced by the State, and thus there was a 40 per cent increase, more or less, in the wage cost for a company.

RODATA itself was founded in 1985 and, as can be seen, has been run successfully since then. Its first and most important task was to ensure that the disabled people working with the firm enjoyed adequate facilities. Part of the profit has also been used for this purpose. After 1985 a travel agency was opened, which organises trips to Hungary for foreign physically disabled people. The income from these trips helps to organise trips for the employees of the company at reasonable prices. They have already visited many countries in Western and Northern Europe and the United Kingdom. As they had been living with their parents or in institutions, most of them would surely never have been able to travel abroad.

Data processing by wheelchair users was a very advanced idea in the early 1980s. The pavilion was planned to meet their needs, and the workplace is easily adjustable. Many companies and enterprises, however, have bought their own computers during the past five years, and it seems easier and

cheaper for them to solve their problems by doing their own data processing. This particular market will survive for a while, but probably not for too long. RODATA needs to look into new ideas over the next two or three years. As it is, the annual profit is not enough to replace the old computers and other obsolete technical equipment. Yet there are no signs of data processing evolving into a more sophisticated technology.

### *QUADRO BYTE*

Towards the end of the 1980s some RODATA workers broke away to form a new company. Most of the RODATA staff were employed as data-entry clerks or as word processors. The new company – QUADRO BYTE – was formed by the more qualified persons who were not in agreement with RODATA's long-term economic strategy.

Unlike RODATA, which relies for so much of its work on a mainframe computer, the new company uses IBM or IBM-compatible PCs. It is active in approximately 15 economic activities, such as management services, publishing, advertising and data processing, but its main activity is in software development, basically for the medical sector.

The company was formed by six persons, four of whom have severe mobility handicaps. They provide part-time jobs for eight other physically disabled people. Their intention is to develop their own computer system with the addition of four new IBM XT and AT computers. Once these are purchased, seven or eight more persons could be given jobs. These purchases will be financed by a grant of 800,000 forints from the Rehabilitation Fund.

Some of the employees hired by QUADRO BYTE use their computers at home. Some of the serious problems of transport are thereby eliminated. The company is purely a profit-oriented firm, not a special company for vocational rehabilitation or anything else. It has no special profit-tax reduction, and no financial support from the State. The members receive income only as they produce output. Because of their higher incentive (or because the company is better organised), the employees earn about twice as much as they did with RODATA.

### *VersaBraille and Brailab*

The VersaBraille system is well known by blind people all over the world. There are only a few of these computer-based machines in Hungary, possibly 20 in all. All machines are imported and quite expensive.

Brailab is a special small computer for blind people. It was developed by Hungarian professionals at the Central Research Institute for Physics. At the Primary School for Blind Children, almost every pupil has such a machine, which is extensively used for writing. The pupils correct their mistakes with the computer, as a result of which blind children are perfectly able to do rather sophisticated word processing. Brailab has brought computer culture to blind people in Hungary.

The system is not expensive (18,000 forints (i.e. US$300)); but if the parents of blind children cannot find this amount they can get long-term credit, free of interest, to buy the system. More than 300 Brailab machines have been sold; this represents a very high rate of penetration of the blind community. From this point of view, Hungary's results are better than, for instance, those of Germany. Using it in education has caused an undoubted revolution in the training of blind people.

Brailab Plus is a talking computer developed especially for blind people, which can be connected to any type of computer as a talking, intelligent terminal. It allows blind lawyers, telex users, dispatchers and word processors to work at the same level of efficiency as non-blind users. It has opened up new and expanding areas for blind persons trained in computer skills. It is transportable and weighs 5 kg. Brailab Plus is quiet to operate and, if it is used with headphones, the blind person does not disturb his or her colleagues or family. When switched to a text-organising system, it acts as a reading machine.

At present, 50 or 60 Brailab Plus computers are being used by a variety of people, such as a blind computer programmer, a blind phone operator, a school for blind children, a blind linguist, a blind English-language teacher, and so on. One is used by a blind bank employee and another by a blind economist, who works as a programmer in the Central Research Institute for Physics, producing much more than her "able-bodied" colleagues.

With its programmable command language, even blind users who are not skilled in programming languages are able to use Brailab Plus. What is more, Brailab Plus is used to train blind mathematics programmers at the Eötvös Lóránd University, which can accept two new blind students a year. This is most important, because blind people thus have the possibility of entering a new profession in Hungary, i.e. computer programming.

The special computer costs a little less than 100,000 forints (approximately US$1,500), which is far from expensive, considering that it can replicate every function of the American Braille 'n Speak, for a lower price.

## Conclusion

Hungary is undergoing a fundamental political change and is in the midst of a deep economic and social crisis, which may last a decade or more. The present situation of rehabilitation demonstrates vividly the sad heritage of the past. It was particularly neglected during the socialist era, and this state of affairs will not change basically very quickly. However, as we have seen, some disabled people and some deeply motivated rehabilitation professionals realised that they would have to solve their problems by themselves and that no one was going to do it for them – neither the Government, nor the big companies, nor the foreign organisations. In the new political and economic atmosphere of the early 1990s there are certain new initiatives by people and communities, mainly withing the framework of profit-oriented private enterprises, that give cause for some optimism in the near future.

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# Part V. What we have learnt

# 11

# Conclusions and recommendations

*Monroe Berkowitz and H. Allan Hunt*

## The implications of NT for disabled persons

If there is one thing that we have learnt from these inquiries, it is that NT has the potential of improving the lives of disabled persons in a dramatic way. The potential of increasing the job chances of disabled persons is particularly striking.

The possibilities are portrayed in each of the contributions: in the case studies from Sweden, in the IBM examples, in Lawrence Scadden's observations of blind persons in Europe; and they are implicit in the training activities in the United States and Japan. In Hungary too, where NT has yet to make significant inroads, we see disabled persons banding together to take advantage of NT to create jobs for themselves. These examples show more than what might be done; they show what actually has happened in concrete cases as disabled individuals acquire, through NT, the ability to compete in the labour market.

The dramatic examples of success should not obscure the very real problems, however. NT provides access to jobs; but how does one provide access to NT? Just as important, what can be done to encourage the growth of NT adapted to the needs of disabled persons? What should governments be doing, if anything, on the supply side to facilitate the development of NT? Should they intervene on the demand side, and, if so, how and to what extent?

### *One NT innovation*

Before we arrive at any answers, and particularly before we embark on any new grand governmental initiatives in this area, it is useful to examine one successful NT innovation in the United States, Braille 'n Speak. This is a book-sized portable which, for want of a better name, one might call a computer, but one that has no display monitor. It is meant for use by blind and visually impaired persons with a knowledge of Braille. The user presses the seven keys to input Braille characters. These are immediately translated into the standard form known as ASCI, and a voice synthesiser combines the letters into syllables and speaks the appropriate word. Once the material is in ASCI, the

computer may be connected to a Braille or ink printer and receive output; or the device may be cabled to a PC or other computer and the material uploaded to one of the word-processing languages such as WordPerfect. Braille 'n Speak can store 20 kilobytes of material (about 47 written pages).

We describe the device, not for its own sake (although it has turned out to be a most useful piece of NT) but because of its origin and manufacture. It is the product of a small engineering firm which until recently was run only by the inventor and his son. They used existing hardware – off the shelf, as it were – to develop the product. The software was developed cleverly with the needs of blind persons in mind, and the whole was effectively packaged and marketed. The device costs only US$800, and some 3,000 have already been sold. This is one piece of NT that can be bought by individuals from their own funds, as well as being bought by third-party purchasers.

Our aim here is not to advertise this particular piece of NT since there are surely many other such examples, with varying degrees of success. (In Chapter 11 a similar device manufactured in Hungary is described.) The point to be made here is that this is an instance where the market is, apparently, working. Someone saw the need and responded to it by taking readily available hardware and devising the appropriate product, using a great deal of ingenuity. Enough units are being sold to reward the entrepreneurs, and the lives of a considerable number of blind persons are being improved. Governments played no role on the supply side. To be sure, some of the units may be purchased with the aid of governmental funds supplied to the purchaser; but any intervention has been of this indirect nature.

One major theme running through all the contributions has been the interplay between governmental, private-sector and voluntary activities. We discuss the possible roles and functions for government intervention below; but first we examine the particular areas dealt with in this volume. Although we have already alluded to some of these findings, we summarise what we have learnt in each area.

## NT training programmes for disabled persons

We have three contributions under this heading. Cornes, Floyd and Boeckenfoerde surveyed the NT training programmes operating at present in Great Britain. Lawrence Scadden looked at the effects of NT on blind and visually impaired persons in four Western European countries. Leahy and Leneway examined two traditional rehabilitation centres as they made the transition to training in NT. All three of these chapters emphasise the dynamic nature of NT. The "new technologies" deserve the appellation "new" if only because they are constantly changing. Leahy and Leneway show how difficult it is to gear up an existing institution to train persons for NT – and how frustrating it is to see the programmes becoming outmoded in a few short years. Scadden points to the efforts to train blind computer programmers, and then the frustration of their not being able to get jobs. Cornes, Floyd and

Boeckenfoerde show how the many programmes in Great Britain have been able to move swiftly to accommodate changes in the market.

All three chapters emphasise the importance of public- and private-sector involvement in the training programmes. In the United States, in Great Britain and in the four European countries examined by Scadden, the training programmes are underwritten by one government programme or another. But the successful programmes are those which are carried out in collaboration with the private-sector employers. In Great Britain these programmes were begun in the voluntary sector, and the authors feel some concern that current plans to emphasise the role of the private empployers may jeopardise these successful efforts.

The jobs to which these disabled persons aspire are, by and large, in the private sector. This is not to ignore the governmental jobs. In Denmark the Government has apparently paved the way by making accommodations for blind persons so that they may work at productive jobs; but the principal job markets are in the private sector. It makes sense therefore to develop programmes in conjunction with future employers and to be guided by the demand for workers as expressed by those employers.

Scadden points out that one advantage of the involvement of the private sector in these training programmes is the flexibility exhibited in this sector. Three or more years may elapse in France before a change in direction in a programme can come about. The private programmes, whether sponsored by voluntary agencies or by private firms, can move quickly. In the American experience related by Leahy and Leneway, once the rehabilitation centre realised that its computer training programme was outmoded, it was able to turn it around quickly with the aid and advice of its Business Advisory Council.

The British contribution details the amazing variety of programmes that have developed in this area. Most of these derive from the initiative of the voluntary sector. Started by diverse groups, the programmes have targeted different client groups and have adopted different training methods. The authors fear that changes in policy may threaten these programmes; but so far they stand as examples of how smaller groups can be adept at discerning a need and formulating effective programmes to fill the gap.

Scadden has some penetrating observations and recommendations to make after he looked at the programmes for blind persons in Austria, Denmark, France and Germany. He agrees that new job opportunities have been stimulated by NT, and that there have been some effective mechanisms for training blind persons to use NT for employment; but these have not been enough to meet the growing demand. He recommends that governments consider expanding training conducted under contract with skilled trainers rather than enrolling individuals in specialised training facilities. He recommends that the trainers be drawn from the ranks of blind NT users.

One of Scadden's recommendation deserves emphasis in that it touches on a common theme found in so many of the other contributions. His view is that educators and rehabilitation professionals must develop mechanisms that will encourage blind and visually impaired persons to obtain the

highest possible level of education and training. It is obvious that a high level of general education is necessary to absorb the NT training, especially when one considers the future job changes that may be in the offing.

Leahy and Leneway examine in detail the changes that two rather traditional rehabilitation facilities had to make to prepare themselves to train disabled persons for NT occupations. Two lessons emerge clearly from their experiences. One is the vital necessity of staying in touch with the labour market and with the firms that will eventually hire the persons being trained. The other is that positive benefits accrued to the rehabilitation institution that underwent the self-examination that preceded their changed outlook. It was humbling for the rehabilitation counsellors to see their disabled clients pick up skills that they themselves had not yet mastered. In a real sense, the business advisers and the rehabilitation professionals both profited when the two cultures interacted. The business people were able to see disabled persons as real people with everyday problems, and the rehabilitation personnel were forced to alter their traditional methods of doing business in the light of NT developments. Above all else, the training institutions learnt that nothing lasts for ever in the field of NT, and that it was important to keep abreast of the latest developments, both in NT and in the job market. The lesson that survival depends on the rapid ability to adapt to new conditions is paramount.

## New access technology and the employment of disabled persons

In Part III of this volume we have three contributions. Breding and Keijer examine the TUFFA programme in Sweden; Okada and Yatougo look at the contributions of NT to employment access in Japan; and Chigier investigates some of the innovative activity in this area in Israel.

All three contributions illustrate their findings with case studies drawn from national experience. The Japanese rely on grants to individual firms from funds derived from their levy system. These have been used to provide access to jobs in the firms which have been enterprising enough to have applied for the project funds. The Swedes have specialised in customising NT for particular persons at particular workplaces. The Israeli experience, which extends to technical aids as well as to NT applied to employment, comes from agency and university examples.

These three contributions show how difficult it is to bring the advantages of NT to disabled persons. As the Swedes describe the details of the process, the problems are mind-boggling. Procurement, guarantees, specifications, testing at the workplace are all formidable obstacles that have to be considered and planned for. Any country or, for that matter, any agency that seeks to install an NT device to promote employment would be well advised to read and study the Swedish contribution thoroughly.

*Inter alia*, they would learn the value of what Breding and Keijer call the "holistic" approach. The hardware and software of NT are, in many ways,

the easiest part of the task. They learned early in their experience that a good deal more was involved than simply adapting a computer and equipping it with peripherals. As they put it, "The psychosocial aspect is particularly critical, as for instance in the relationship between disabled persons and their colleagues and the foreman." That proposition is constantly illustrated in their case studies.

Japan is one of the most technologically advanced nations in the world. The levies and grants under its quota system would seem to provide an ample source of funds to finance NT applications for disabled persons. Yet progress has been slow, and applications have been largely confined to sensory-impaired persons. Although the total number of cases financed under the levy and grant system is low, it is encouraging that the number is increasing. Perhaps it is somewhat premature to evaluate the Japanese system. The applications described by the researchers show evidence of thoroughness of planning and willingness to bring the latest technological developments to the aid of disabled persons. Japan is actively trying to solve the thorny problems of developing systems that can read the Chinese characters.

Israel's experience shows the vitality and ingenuity that comes from having university-based and other innovators apply themselves to these NT problems. The market in Israel is small, and devices tend to be inexpensive and adapted to local conditions.

## Placement and employment of disabled persons trained in NT

Each contributor to this volume is concerned with the placement and employment of disabled persons. The two contributors in Part IV focus on this issue – which is, after all, the ultimate purpose of training and providing access.

Jacques Dawans, based in Belgium but with a wider interest in IBM-influenced programmes throughout the world, relates some of the activities with which his company has been involved. The company recognised the need for the holistic approach emphasised in the Swedish contribution. Consequently, its projects have been developed in collaboration with employers' and rehabilitation groups. Its various programmes have concentrated on training persons in the use of NT and on assuring their placement in jobs where their newly learned skills can be put to use.

Examining the Hungarian experience, Konczei believes that it is necessary to loosen the restrictions on what is meant by NT to include some of what might be considered elsewhere to be low technology. Hungary is undergoing rapid and dramatic social, political and economic change at present. But rehabilitation has lagged behind since, under the old regime, disabled persons were too often relegated to benefit status without much attempt being made to return them to the job market.

But even in a situation where conditions look less than optimistic, there have been examples of activities which may be worth emulating. The outstanding lesson to be derived from the Hungarian experience is that disabled persons themselves have the ability to band together and form their own companies to take advantage of NT. To be sure, some of the early efforts centred on data entry operations which were outmoded when the personal computer came on the scene. But newer efforts centre on more sophisticated programming and other NT applications. In one sense, these efforts greatly resemble a sort of independent living movement, where disabled persons take hold of their own destiny. If such efforts can be encouraged, as NT develops in Hungary, these groups of disabled persons should be able to take advantage of the new developments.

## The possible role of government

Each contributor examines in some way the interplay between the voluntary, the private and the governmental sectors. Each recognises that government has some part to play. We look first at some of the possible governmental functions and roles that might receive widespread endorsement.

### *Stimulating basic research*

One role is in the area of basic research. Although we stated earlier that government played no part on the supply side in the development of Braille 'n Speak, that is not strictly true when we consider the components of the device, and particularly the microprocessor. The microprocessor is a product of long years of research and experimentation at both the university and the commercial levels in the United States. The whole thrust towards smaller and smaller components has been stimulated by the space programme and associated research. As we look at the continuing research into fibre optics, into further miniaturisation, into new methods of handling large masses of information, we realise that we are entering a new era of communication where the distinctions between computer and data transmittal, between the telephone and voice messages, between the facsimile machine and written messages, and even between television and its entertainment, will be breaking down. Much work remains to be done, and governmental activities will play a large role in stimulating, and, in some cases, underwriting basic research to push back the frontiers of knowledge.

These research and development activities are evidently by no means confined to the United States. Okada and Yatougo describe some of the current developments in Japan, and Chigier describes some of the developments in Israel.

## *Providing information*

Another non-controversial role for governments is to provide information. As was recognised in the analysis of the "knowledge" industry, information has a cost and there are limits to how far governments should go in providing information. None the less, there are areas that cry out for further information and documentation, some of which we list below.

### *How many disabled persons are there in a country?*

To ask this question is to expose our ignorance in this basic area in so many countries, including some of the most economically developed. This is especially so when we realise that we want to know not only the number of persons with a particular impairment, but also the severity of the impairment and something of the characteristics of the person. In short, what we need is a market survey that will reveal something of the effective demand for a contemplated device under particular circumstances.

At the moment, in so many countries, one has to guess at the potential demand. Governments can carry on actual development work and, in some cases, as in Sweden, order devices for particular people at particular workplaces; but even in Sweden, it is recognised that these are prototypes and that the question of the eventual demand for these adaptations is still relevant.

### *What NT devices and equipment are currently available?*

Although one ought not underestimate the ability of the private sector to advertise and make known its products, there is probably a role for governments to play in providing information about existing products. There are many examples of such registries and communication efforts. In Europe the most prominent example getting under way is HELIOS, which tackles the problem of making information available in different languages. Hong Kong has an extensive information library, RehabAid, run in conjunction with the Jockey Club Rehabilitation Engineering Centre in the Hong Kong Polytechnic. Many state vocational rehabilitation agencies in the United States have sponsored such centres where up-to-date information is available.

### *How do the devices work and how can they be applied at the workplace?*

In this project, we are engaged in one type of this activity. We are illustrating how NT is being applied in several countries throughout the world, but we have not gone on to the next crucial stage of evaluating its benefits and its costs.

One of the difficulties is the extreme shortage of materials available on the actual application of NT in concrete situations. It seems as if projects in

various countries are so busy supplying NT devices and equipment that little time is available to evaluate the work, or to write up the stories they have to tell. Particularly relevant in this regard is the experience of Sweden, which has begun to disseminate some information about its TUFFA project.

As we can see from Breding and Keijer's chapter, they are convinced that a holistic approach is necessary. Among other things, this means contracting with the supplier to have the product tested not in the laboratory but at the workplace. It is recognised that the reactions of the user are important, as are the reactions of colleagues and supervisors. What looks good on the drawing-board may fail at the worksite for reasons which were not even contemplated when the needs of the person were assessed.

The need for evaluation will become more and more serious as NT proliferates in employment areas. Japan is making NT available under its grant programme, but apparently has no general scheme under way to evaluate its experiences. Little evidence of systematic evaluation activities can be found in the countries examined by Scadden.

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*What is the current state of the job market, which jobs are increasing in importance and which are declining? What will be the future labour supply and demand in various NT occupations?*

Hindsight is, so often, so much more accurate than our attempts to divine the future. Labour market forecasts cannot claim to be precise, but they can at least yield some clues as to the future development of well-established trends. Obviously, such information is of primordial importance for training programmes for disabled persons.

In Japan blind persons are being trained as masseuses and acupuncturists, which may or may not be the occupations of the future. In Europe blind persons are being trained as typists or telephonists, at a time when these occupations are declining. As Cornes and his colleagues in the United Kingdom and Leahy and Leneway in the United States observe, it is a constant struggle to keep training programmes up to date so as to take advantage of the job openings that will be available when the graduates come on to the market. The American experience, as noted below, depends on strong cooperation with Business Advisory Councils; but government also has a role to play in making labour market forecasts widely available.

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*Providing and encouraging training*

One of government's traditional roles is to provide education and training – mainly for children, but ever more for adults. A recognition of the disruptive effect of NT – that old industries disappear while new ones surface, that old jobs and entire occupations may become one of the casualties of the changing industrial scene – prompts us to pay more and more attention to training and retraining programmes. It is forecast that people may well have two or three occupations in a lifetime as the pace of technology quickens.

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Governments have traditionally invested heavily in education. They remain heavily invested in existing institutions and in traditional ways of doing things. It is important, therefore, to examine how traditional training institutions can turn around and prepare themselves for training disabled persons for NT occupations. The pluralistic approach in Great Britain, the constant self-searching in American rehabilitation facilities, the tailoring of NT devices to specific worksites in Sweden, the initiatives of the disabled groups of persons in Hungary, illustrate the many ways of approaching the problem. In each of these cases, there was a willingness to abandon traditional programmes and traditional ways of operating to meet the new demands posed by NT. Unfortunately, as the survey of blind programmes in Europe shows, flexibility and the ability to adapt quickly to the new situation are paramount.

### *Disability policy*

Closely allied to its role in the research, information and training sectors, governmental activity will be guided by its overall disability policy. Public policy on disability has many facets. First and foremost is the policy on disabled persons' access to the labour market. If NT is to be effective in promoting the employment of disabled persons, such persons must have the right to compete for jobs on equal terms with others. Such a policy requires that disabled persons be judged on their abilities to perform at the workplace and not on their medically defined physical condition. As a minimum, there must be no discrimination because of mental or physical condition.

Some countries have chosen to adopt a quota system, which prescribes the employment of a certain proportion of disabled persons. Such a system has disadvantages, not the least of which are the difficulties of enforcement and the fact that firms can buy themselves out of the quota requirements by paying a levy. But some nations seem to be comfortable with this type of mandatory system.

Public policy also requires that all benefit programmes be examined to determine whether they contain disincentives to employment. As we have seen from the examples in Japan and in Europe, many countries supplement their benefit systems with wage subsidies to employers who hire disabled persons, or with funds designed to defray accommodation costs. Such funds might also be used to make NT devices and equipment accessible to disabled persons.

## *The paths ahead*

The whole purpose of this study is to allow one country to learn from the experience of others. What is most apparent from this review is that each country has something to teach others. However, our volume is isolated, a one-time effort, and the interchange of information ought to be on a continuing basis if it is to serve its purpose. In what areas, and in what subjects, should such an exchange of information take place?

*Employment effects*

The overall or macro-effects of NT have been explored; but too little is known about the employment effects of NT on the job chances of disabled persons. A database is gradually being accumulated in some countries, such as Japan. With some systematic attention to detail, we should be able to have some concrete, up-to-date information about the employment effects of NT. This information needs to be transmitted at an international level. Specifically, one needs to examine the employment chances of women, older persons, disabled persons with mental illnesses, and those persons with limited educational attainment. NT can affect the labour market situation of these groups favourably or unfavourably, and specific experience in this regard needs to be explored in greater depth.

*Training programmes*

As we have seen, there are many training programmes to equip disabled persons for NT jobs. These vary in length of programme, sponsorship, financing, relationships with employers, and effectiveness. It would be useful it information about such programmes were continuously available, particularly as regards their tackling such problems as selection and placement. The success or failure of particular programmes could then be more swiftly shared with others.

*NT applications*

It would be useful to have some continuing and regular exchange of information on the applications of NT, particularly on access to jobs. The most numerous cases of application of NT have been, by far, for sensory impaired persons. This is understandable; but as the TUFFA experience makes clear, the potential for the application of NT in jobs for mentally retarded persons is exciting, as it is for persons with severe physical disabilities. There would seem to be no reason why each country in the world should not "reinvent the wheel" in this area. Some exchange of information on an international level would be extremely useful, especially for those countries which are only now developing NT.

*Evaluating the experience*

In this project, we have had to be content with describing each country's experience in the application of NT to the disabled persons' problems. In some countries, we have concentrated on access and employment; in others, on training programmes, in others, on placement and employment. But, for the most part, this is merely a catalogue, or a snapshot, of the experiences in each area. We have some idea now, after examining these reports, of the experience in these areas in each country.

We should really take the next step and evaluate the experiences recounted in the preceding chapters, so that we can judge which are really worth emulating. We have concentrated on the employment of disabled persons in the open competitive labour market. In such a market, people will not be employed unless their marginal product – what they produce – is at least equivalent to the wage they are being paid. We need to learn more about the successful training and placement of such persons, about their earnings, and something about their periods of employment and unemployment.

Training programmes entail costs, whether these be borne privately or paid for by some societal programme. Obviously, as we look at the descriptions of the programmes in these chapters, we find that some are considerably more expensive than others. The question that we cannot answer, on the strength of the data gathered thus far, is: which of these programmes is the more efficient? In short, we need much more analysis of the costs and the benefits of the training programme if we are to make intelligent, public policy decisions.

### *Public policy options*

What should a country do to encourage the application of NT to further the employment chances of disabled persons? The range of options is considerable, and a full consideration of each would take us well beyond the confines of this project. None the less, some options merit our attention.

First, NT employment is, after all, only one area of employment for disabled persons and basic public policy as to antidiscrimination policy, benefit policy, etc., must be examined to determine its effects on the employment of disabled persons. Training appears to be a valid investment, and public policy which encourages this development of human capital seems to be worth while (although documentary evidence is sparse). Beyond that, there are some public policy issues that pertain more narrowly to NT and to employment. For example, a 1986 law in the United States (Public Law 99-59-506, Section 508, 29 USC. 794d) provides that federal agencies "shall provide handicapped and non-handicapped employees equivalent access to electronic office equipment to the extent such needs are determined by the agency... and the required accessibility can be provided by industry..." The law went into effect in 1988 and it is therefore too early to measure its effects; but it does indicate another approach to NT that should be investigated.

The federal Government is obviously a major purchaser of electronic equipment in the United States, and what it requires will also influence private industry. In fact, this law should result in changes in some of the basic precepts of vocational rehabilitation and, if effective, should remove some of the cost differentials between employing disabled and non-disabled persons. It will be several years before its effects are known; but this delegation of certain features should be closely watched. It implies the provision of closed caption devices on television, and the provision of spoken commentary on television programmes for blind persons.

## Conclusion

Aids and prosthetics have been with us since the first disabled person took a tree branch and fashioned a crude crutch. But NT devices and equipment are different in number, quality and kind. They introduce relatively new phenomena, which are just evolving. We should not be surprised to learn that we have not solved all problems of training, access or employment. What we have learned is tantalising. Obviously, some disabled persons who would, in an earlier era, have been effectively banned from employment can now lead productive lives. Since the possibility exists, it would be a disgrace if we were not able to master the technology and to muster the will to bring the advantages of NT to those disabled persons who could most profit by them.

# Other ILO publications

**Self-employment for disabled people: Experiences from Africa and Asia,** by Malcolm Harper and Willi Momm

The book is the outcome of a survey of 53 businesses run by disabled people in several African and Asian countries. At its core are 16 case studies, showing how the disabled entrepreneurs succeeded in self-employment, and highlighting the problems they faced. At the same time, a survey of 32 rehabilitation institutions is used to examine how far they served the needs of their disabled clients who chose self-employment.

The book contains invaluable advice for planners and rehabilitation professionals in developing countries and presents a spectrum of new possibilities for practical and appropriate services designed to promote self-help and economic self-reliance for disabled people.

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**Vocational rehabilitation for women with disabilities,** by Sheila Stace

In both developed and developing countries disabled women experience dual discrimination – firstly because of their sex and secondly because of their disability. This concise monograph concentrates on the problems facing the world's 160 million disabled women in gaining entry to vocational rehabilitation and training programmes, and employment. It also highlights the lack of career opportunities. The author suggests that this discrimination could be overcome by such measures as further research, greater flexibility of entry conditions for rehabilitation, training and employment, the extension of programmes of action and changes in public attitudes.

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**Basic principles of vocational rehabilitation of the disabled**

Rehabilitation in the broad sense of the term poses a problem to the community which challenges many specialised skills and involves a number of separate disciplines and different services. This booklet, prepared for the use of national and international experts working in the field of vocational rehabilitation, presents in a condensed and abbreviated form the basic principles of the vocational rehabilitation process. The third edition has been revised in the light of the Vocational Rehabilitation and Employment (Disabled Persons) Convention, 1983 (No. 159), and Recommendation, 1983 (No. 168).

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